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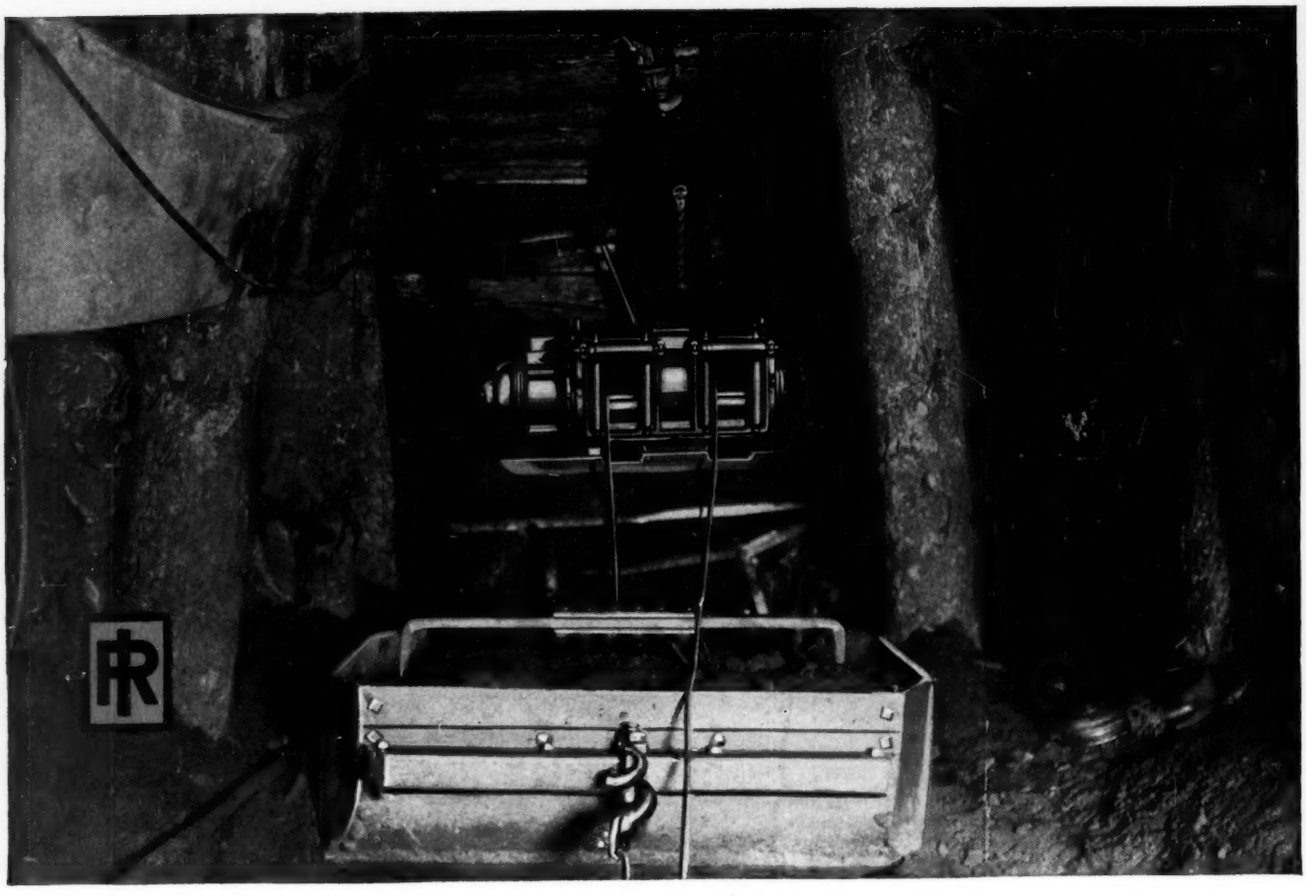
February 9, 1931

Sixty-second Annual Review and Statistical Number



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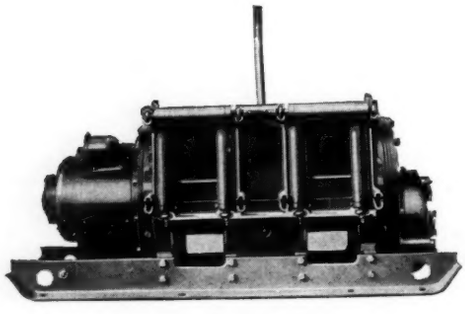

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The SIXTY-SECOND ANNUAL REVIEW

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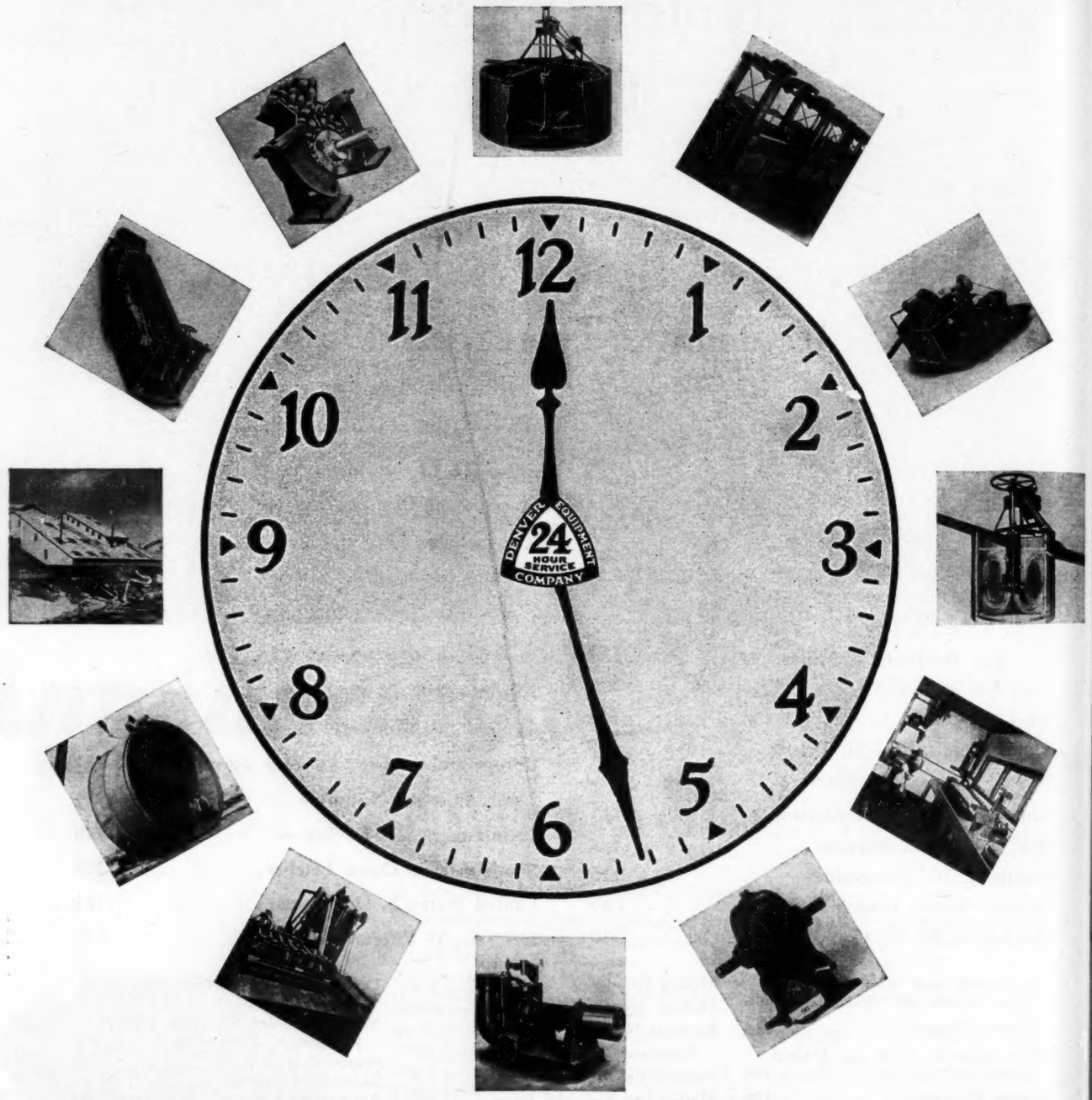

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Engineering and Mining Journal

February 9, 1931 A. W. ALLEN, *Editor* Vol. 131—No. 3

Research and Reasoning In Economic Rehabilitation

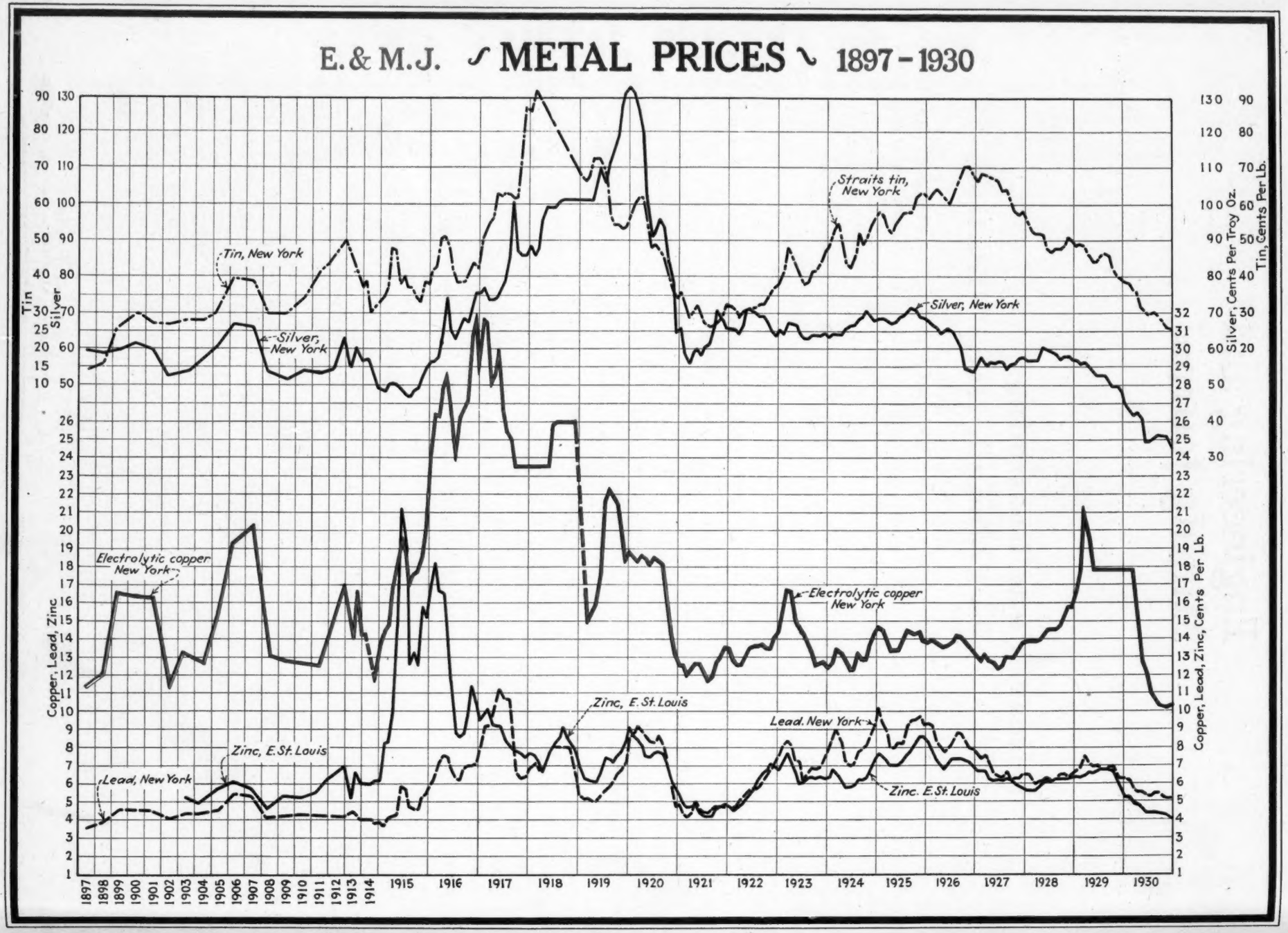
THE YEAR just past and its immediate predecessors have laid a firm foundation for continuous technical advance. Rapid strides in pure science and industrial research have been recorded, yet the engineering industries are far from an ideal of precision or perfection in the operation of processes or machines, or in the utilization of man-power, mental as well as physical. The phenomenal advance in applied mechanics and chemistry and physics, however, justifies the conclusion that the engineer is a century ahead of the banker or the economist. Unlike either, he has based his plans and prognostications of happenings on facts born of reasoning and experience, matured by the results of an interchange of knowledge—in reaching an accord with his confrères—that has eliminated what was proved to be technically weak or inadequate. His laws have been laws of facts, not of economic tradition. In building a structure of efficient and economical production he has gambled only with his own reputation, to emerge with credit.

◆ Adversity is not without comfort and hope, according to a sixteenth-century philosopher who lived in an age when satisfaction was measured mostly in terms of physical enjoyment, with little indication on the horizon of a trend indicating national progress, as we see it today, or individual well-being. If comfort and hope were concomitants to adversity in those days, how much more reason have we, of the twentieth century, to be thankful; especially now that the radio and the wide use of the printed word bring immediate knowledge of conditions and trends, stimulating individual initiative and progressive action.

The one outstanding hope and comfort is that 1931 has ushered in new standards of thought as to the proper relation of government to industry, of industry to employee. If mental armor can be forged to deflect the meaningless catch-phrases that have linked creditable technical accomplishment to faulty economic control for so many years; if a resistance can be developed against that unwritten statute "Thou shalt not reason"; if the engineer's philosophy of intellectual sincerity and respect for facts be injected into the restrictive or permissive legislation found necessary—then and then only will come opportunity for steady advance, social as well as industrial.

◆Aristotle maintained that education was an ornament in prosperity and a refuge in adversity. Only by education and through education can come realization that laws, written and unwritten, like technical process or apparatus, are fashioned to fit conditions prevailing at the time of acceptance. Change for the better is the record of engineering history, because such change is planned and worked for. Retrogression in national well-being, a sign of inefficiency in economic control, is the outcome of unpreparedness, illogical forecasting, misplaced confidence, and speculation with theory instead of investment in fact. The employment of research and the encouragement of reasoning, in matters economic as well as technical, constitute the first step toward rehabilitation. To look back is to admit their favorable influence on progress. To look forward, having accepted this philosophy, is to discern promise of orderly advance in the direction of a high level of general well-being.

A. W. Allen


E. & M. J. METAL PRICES 1897-1930
Tin
Silver
Copper, Lead, Zinc
Silver, Cents Per Troy Oz.
Tin, Cents Per Lb.
Copper, Lead, Zinc, Cents Per Lb.
Straits tin, New York
Tin, New York
Silver, New York
Silver, New York
Electrolytic copper New York
Electrolytic copper New York
Zinc, E. St. Louis
Lead, New York
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Lead, New York
Zinc, E. St. Louis
1897 1898 1899 1900 1901 1902 1903 1904 1905 1906 1907 1908 1909 1910 1911 1912 1913 1914 1915 1916 1917 1918 1919 1920 1921 1922 1923 1924 1925 1926 1927 1928 1929 1930

Gold

Robert J. Grant

Increase in Mining Typifies Period of Economic Adversity

ALTHOUGH the amount of new gold produced in 1930 in the United States increased by half a million dollars, no reason exists for a belief that the depression has had, or is likely to have, any important influence on the world gold-mining situation. True enough, miners turn to gold when employment is slack at other metal mines, but the additional production that results is not great. Gold mining always becomes attractive to both labor and capital in times of adversity. The resulting speeding up of the industry at a time when other activities are slowing down makes a spectacular contrast. This frequently gives an exaggerated impression as to the rate of production. Under present-day conditions such reductions in costs as may come about in a time of depression have relatively little bearing on output.

Improvement in mining methods and mechanization are doing much more to reduce the costs of gold mining than any saving that can be made in wage rates or because supplies are cheaper. During the depression of 1930-31 little change in the wages paid has occurred. Supplies represent about 40 per cent of gold-mining costs, but prices have not been enough lower to have any important bearing on total costs.

World Production of Gold 1929 and 1930

In Fine Ounces

Country	1929	1930
Transvaal	10,414,066 (a)	10,719,760 (a)
United States	2,208,386 (b)	2,232,593 (b)
Canada	1,928,308 (c)	2,089,766 (c)
U.S.S.R. (Russia)	835,918 (d)	868,068 (d)
Others	4,126,152 (e)	4,589,813 (e)
Total	19,512,830 (b)	20,500,000 (e)

(a) South African government sources; (b) U. S. Bureau of the Mint; (c) Dominion Bureau of Statistics; (d) Non-Ferrous Metals Trust, U.S.S.R.; (e) Estimate by *Engineering and Mining Journal*.

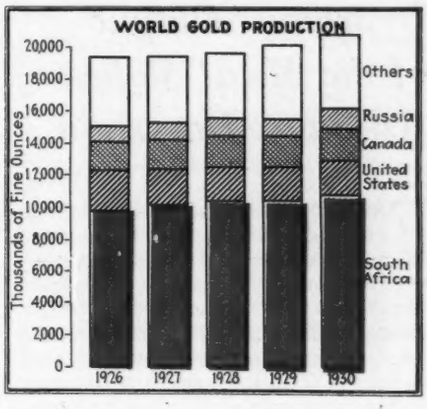
Although gold production will probably be well maintained for the next few years, a material decrease in production cannot be postponed much longer. This applies more particularly to the production on the Witwatersrand. Further reductions in mining costs there are reported to be in prospect, owing to the fact that native labor has become sufficiently proficient to make it possible to dispense with the white employees now used under ground who receive much higher wages. If important economies can thus be effected, the Rand will probably be able to mine and mill lower-grade ore than had been estimated heretofore. With due allowance for some extension of the life of the South African properties, all reports seem to agree that the mines, which are the mainstay of the present rate of world production, are certain to show a great slump in output before the end of another decade.

With the certainty of an eventual material decline in gold production, to give this matter some attention would seem to be the province of government. Bankers and business men usually are absorbed with more immediate problems. Many of them think the world will get along just as well with a materially reduced output of new gold. Some distinguished authorities declare that to worry about gold production is unnecessary, so far as the financial situation is concerned. Other eminent students of the situation are alarmed at the prospect.

One thing is certain: no precedent exists to guide us in attempting to determine the relationship between gold production and credit expansion. Inasmuch as commercial interests can hardly be expected to look that far ahead, some prominent authorities are suggesting that the government should undertake studies along that line. A carefully selected fact-finding commission chosen from government specialists doubtless would be a constructive step. Deferment of the appointment of such a commission until the League of Nations will have issued its final report on the gold situation would, however, seem to be advisable.

With annual additions to the monetary gold supply of the world running less than 5 per cent of the existing supply, some persons are inclined to say that this amount is not sufficient, but evidently the whole subject could well be illuminated further by additional studies. Others advocate the reservation of all bullion for the purpose of using it as a basis of credit; they would go even so far as to deny gold to the consumers in the arts.

In that connection, however, attention is drawn to the fact that the use of gold in the arts in the United States has been declining, the total value of the gold so used each year from 1921 to 1930, inclusive, being as follows: 1921, $40,300,000; 1922, $47,700,000; 1923, $57,600,000; 1924, $56,600,000; 1925, $53,500,000; 1926, $54,100,000; 1927, $50,000,000; 1928, $47,900,000; 1929, $45,800,000; 1930, $32,800,000, according to a recent estimate.



Gold output of the United States in 1930, according to a preliminary estimate of refinery production, amounted to 2,232,593 oz., compared with 2,208,386 oz. in 1929. Of this total for 1930, Alaska contributed 394,779 oz. and the Philippine Islands, 178,934 oz.

California, as in 1929, was the heaviest producing state, its output totaling 438,912 oz., compared with 409,020 oz. in 1929. According to the U. S. Bureau of Mines, gold from the lode mines of the state increased in 1930, with practically all of the larger mines showing a gain in output. Placer mining, confined largely to dredging operations, again decreased, but active mining of copper ore during the first half of the year helped to increase gold output.

Despite a serious fire in July, the Homestake mine, at Lead, S. D., the largest producing gold mine in the United States, increased its production $1,900,000 over the 1929 output. Gold production of South Dakota was 402,422 oz. in 1930, compared with 312,328 oz. in 1929. In Colorado, gold output totaled 214,195 oz., compared with 220,285 oz. in 1929. The Cripple Creek district production was valued at $2,526,677, and that of San Juan County, at $658,357.

Gold production in Utah decreased materially in 1930, the output being 200,103 oz., compared with 237,221 oz. in 1929. This decrease was accounted for by the materially reduced scale of operations of the Utah Copper Company.

Although the 1929 rate of output of Nevada Consolidated and that of Elkoro Mines was maintained, Nevada's gold production declined to about $2,729,000 in 1930, compared with $3,384,211 in 1929.

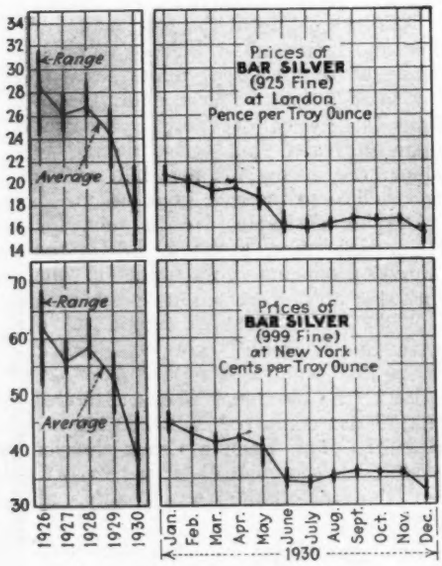
Silver

H. M. Bratter

Byproduct Output of the Metal Makes Its Future Uncertain

FROM 46⅞c. in New York and 25⅝d. in London on Jan. 2, 1930, the price of silver declined during the year to new lows of 30¼c. in New York on Dec. 30 and 14 7/16d. in London on Dec. 31. Owing to the decline in prices throughout the year, many mines were forced to close down or to curtail production. As the major part of the silver produced is a byproduct of copper and zinc, however, output is not entirely governed by the price of the metal.

During the last year China has suffered from civil war, crop failures, likin [taxes on goods in transit], coastwise trade dues, and other impediments to export trade. Accompanying these conditions, silver came out of hiding and flowed to Shanghai for safe-keeping, swelling the Shanghai silver stock to an abnormal figure. In addition to the disturbances in China, boycotts of foreign goods and political unrest in India prevailed throughout the year. Several local conferences were held in China and many suggestions were made for support of the price of silver. The consensus of opinion was, however, that attempts to stabilize the price of silver could not be successful. In the opinion of Mr. T. V. Soong, China's Minister of Finance, the remedy does not lie in artificial measures. He denied that plans to circulate gold coin in China were being considered, and stated that any monetary reform would inevitably require a much increased circulation of silver. (This does not mean that a gold standard is not being contemplated, but that such a currency reform will not call for circulation of gold coin.)



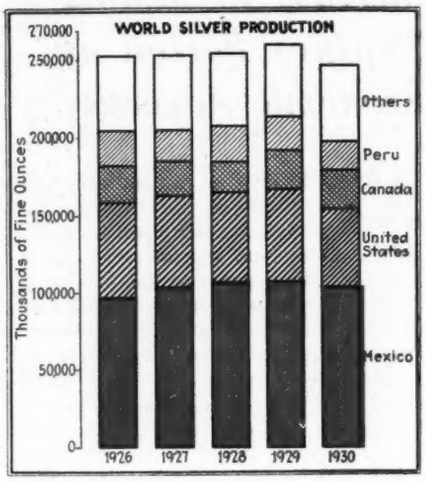
As a result of the lower price of silver, manufacturers of silverware announced a 10 per cent price reduction in August. The average New York silver price for 1930 was 38.154c., as compared with 52.993c. in 1929 and 58.176c. in 1928. Production showed a slight decline during 1930, the average monthly world production being 17,985,000 oz. in the first nine months, as compared with 18,990,000 for the entire year of 1929.

China being the world's chief consumer of silver, the Shanghai silver stocks are important as a key to world demand. These stocks showed an increase from 107.9 million ounces on Jan. 1, 1928, to 147.2 million ounces on Jan. 1, 1929, 192.4 million ounces on Jan. 1, 1930, and to 216.2 million ounces on Nov. 15, 1930. Despite this growth, many observers state that the stock will prove not excessive when demand from the interior once again can make itself felt.

Partly as a revenue measure, the Indian budget of 1930-31 provided reimposition of the import duty on silver, which was discontinued in 1920. Effective March 1, 1930, the duty was fixed at 4 annas (about 9c.) per Troy ounce. An excise tax of the same amount was imposed on new silver mined in India. The existing import duty for manufactured silver was raised from 30 to 38 per cent, the new rate being made applicable until March 31, 1931.

Without the excise duty, the Burma Corporation would have been able to operate under a protective tariff of 4 annas per ounce. The probable reasons for imposing the duty, apart from raising revenue, were: (1) the desire to support the price obtained from the sale of melted rupees out of the increasing Indian currency reserve; (2) the desire to increase the value of the silver holdings of the Indian people. The announcement of the duty caused the market to slip in February. India did, however, continue to import silver, in fact importations continued at a higher rate than in 1929.

In regard to the policy of the Indian government, Sir George Schuster stated that if other interests concerned would consider the possibility of joint action toward regulating sales in order to meet world demand India would willingly co-operate. Concerning the government's policy toward sales of silver, he stated that there might be times when, in the public interest, the government should sell silver. Sales had been conducted with discretion and had been stopped when the market became weak.



In August the Indian government sold 15 million ounces of silver to the Hongkong government. Indian government sales from the commencement of operations in 1927 to March, 1930, totaled 67.8 million ounces. The lowest sale price was 22½d. (45c.), and the average sales price was 25⅜d. (50¾c.) per ounce. Although the government has been selling silver, its stock has not diminished. On Sept. 30, 1930, the currency reserve was 1,159 million rupees in coin and 58 million in bullion, as compared with 1,038 million and 43 million, respectively, on Dec. 31, 1929. Thus, although the price of silver has declined sharply, the silver that the Indian government has to sell has increased rather than decreased. On June 27, 1930, the Bombay bullion exchange passed a resolution to boycott British silver.

Demand on the part of Chinese on the mainland for the paper notes of Hongkong banks became increasingly disturbing to business in 1930. This demand necessitated import of British silver dollars. Grave warnings were issued on different occasions concerning

A more complete monograph by Mr. Bratter on the subject of the economics of silver will be released by the Finance and Investment Division of the Bureau of Foreign and Domestic Commerce, U. S. Department of Commerce, early this month.

the continued importation of silver dollars, as the accumulation of silver might involve Hongkong in serious difficulties.

The French government is accumulating silver in order to replace badly worn small paper notes with silver coin. Silver experts stated recently that 10- and 20-franc pieces have been minted since early in 1929, but no attempt has been made to put them in circulation. A feature of the French currency situation is that France has in its vaults more than enough silver to meet the coinage needs. After stabilization of the franc, the government's silver stock was increased by the reappearance of previously hoarded coins. During 1929 the Bank of France is said to have sold 10 million ounces.

French Indo-China was an important factor on account of its sales of silver and preparation for stabilization of the piaster. One estimate indicated sales in 1929 of almost 30 million ounces. During 1930 the colony continued to sell silver, a report stating that 5 million piasters were sold in London, and that the remaining silver stock was about that amount. Indo-China is thus presumably disposing of practically all of its silver stock.

Mexico, the most important silver producer, suffered considerably by the price decline. Many mines discontinued operations; some managed to continue by cutting wages; at other properties the output was increased at the expense of development work, or working time was reduced to as little as one day a week. By a decree dated March 18, the government banned the importation of all silver coins, whether Mexican or foreign. Formerly, Mexican silver coins of current coinage could be imported. The apparent reason for this decree was to keep the discount of the silver peso, as compared with the gold peso, from increasing in domestic transactions. Despite this effort, the gap was gradually widened as the year progressed.

Persia, on Jan. 31, passed a law prohibiting the importation of silver; its exportation was forbidden on Feb. 22. A bill was passed on Aug. 21 permitting the free entry of silver rupees to aid merchants of the Gulf littoral, whose export business with the neighboring coasts of India and Africa was severely handicapped by the government's restriction.

In view of the sudden changes in the price of silver during the last year, predictions of what the future holds in store would be rash. That silver will increase greatly in price without international action appears most unlikely, for there always remains the fact that India has a large silver inventory which will always be for sale at the "right" price. Moreover, the amount of future production is an uncertain quantity, because, in normal times, no less than four-fifths of the world silver output is a byproduct in the recovery of other metals. But should conditions in China improve, a renewed demand from that quarter will no doubt arise. To quote the British Chamber of Commerce of Shanghai, "The present stock (Feb. 15, 1930) in Shanghai would be insufficient to finance China's trade were such trade normal."

Precious Stones

GEORGE FREDERICK KUNZ

IN THE general industrial depression of the year the diamond industry has suffered less than expected. The United States, although producing no diamonds, consumes the largest percentage of the world output, and the depression reacted on the industry, as a whole, in the form of reduced sales. Pending tariff legislation during the first half of 1930 tended to defer importation until the question was settled.

Imports during the first ten months of 1929 averaged more than five million dollars in value a month, the maximum for any month being in excess of over six millions. In November and December, 1929, imports decreased by about a half and remained at this level until the new tariff bill was signed in June, 1930. Average monthly value of imports during this period was $1,800,000, against $5,148,000 during the preceding ten months, but much of this decrease was the result of postponed buying indicated by imports of more than five millions in June, and a monthly average of almost four millions from June to September, 1930. With this rate prevailing for the remainder of the year, the total imports would be valued at 35 million dollars, as compared with 56 millions in 1929, a decrease of about a third.

No estimates of the 1930 output are yet available. During the first half of the year, mine production in South Africa averaged 189,646 carats per month, against 191,125 carats in 1929, a decrease for the year of less than 20,000 carats, but production may have declined further during the second half of the year. Alluvial production during the first half of the year was 79,572 carats per month, against 113,974 carats in 1929. This reduction is in line with efforts by the government and the mine operators to keep the output down, so that it does not seriously hamper the more important mine output. During the first half of 1930 mine production amounted to 1,137,878 carats, and alluvial production to 477,435 carats, a total of 1,615,313 carats, compared with 3,661,212 carats in 1929.

The report of the New Jagersfontein company for the year ended March 31, 1930, showed the largest output since 1914, but all stones were not sold, and, beginning in May, operations were curtailed. Consolidated Mines of South West Africa, at the annual meeting, showed a large increase in profits for 1929. Here also some curtailment was put in effect during 1930, but as this company is working new rich gravel terraces this may not result in materially reduced output. Excessive rainfall in Tanganyika interfered with mining operations, so that the output for the first half of the year was only 6,176 carats, about half of normal.

As a result of reduced demand, the cutting industry experienced a high percentage of unemployment, amounting to 50 per cent in Belgium and Germany in September, 70 per cent in Holland, and even higher in some less important districts. In South Africa the cutting industry is still in a highly unsettled condition. High cost of imported labor, difficulties with the cutters' union over the training of apprentices, and with the government and the Syndicate over the supply of rough stones, seem to be the chief difficulties.

During 1930, two important finds were made in the Burma fields; one a ruby of 100 carats; the other a sapphire of 630 carats.

The beryl developments in South Africa are still progressing, some gem material being produced. South African material, however, cannot compete with Colombian or Russian emeralds in quality. Beryl was also discovered in Manitoba, Canada, but whether this district will be able to produce anything of gem quality, or whether the output will be useful only as a possible source of the metal beryllium, is still a question.

The annual report of the De Beers company for the year ended June 30, 1930, shows sales, expenses, and profits about the same as in the preceding two years. The usual preference dividend of 20s. (£800,000) was paid, but no dividend was paid on deferred shares. This left a balance of £1,401,718, compared with £650,030 in 1929.

More readily to finance the holding of surplus stocks until the market can absorb them, the Conference producers and the Diamond Syndicate organized the Diamond Corporation, Ltd., in 1930, with a capital of £2,500,000, to take over surplus stocks and distribute them over a period of years, so as to interfere as little as possible with current diamond production.

The five-year agreement of the Diamond Syndicate expired at the close of 1930. Conferences, held at various times during the year, were attended by representatives of the producers, the Syndicate, and the South African government to arrange for continuation of the agreement and to apportion new quotas for the producers, as well as for the government.

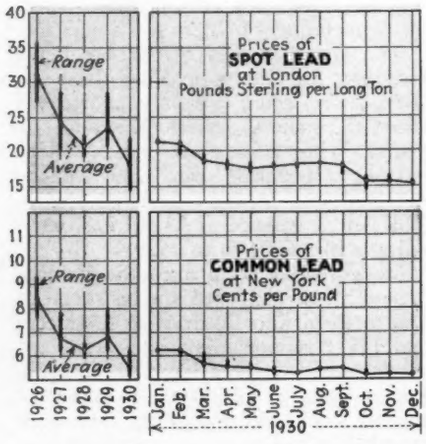
Lead

Clinton H. Crane

High Rate of Output Results in Abnormal Refined-Metal Stocks

MEASURED solely by the amount of lead produced, the year 1930, poor as it was, does not appear to have been one of great depression. World lead output of 1,830,000 tons was roughly equal to the amount of lead produced in 1928, and only 5 per cent below the record-breaking tonnage of 1929, which was 1,935,000 tons. The fact that world production continued at so high a rate in the face of almost steadily declining volume of business and prices is, of course, the reason why stocks of refined lead grew to abnormal proportions in the United States and Europe.

An analysis of production statistics shows that the decline in the lead output of the United States was relatively greater than the average for the entire world, about 605,000 tons being produced from domestic properties in 1930,



compared with 688,000 tons in 1929, which represents a reduction of a little over 10 per cent. Spain likewise accounted for a substantial part of the cut that was made in world production, but other major lead-producing centers kept up at a high rate, notably Germany, which seems to have established a record output for that country in 1930—127,000 tons. It is peculiar that foreign countries receiving smaller unit returns for lead exhibited less of a tendency to curtail production than mines in the United States which received higher prices.

The situation in lead is complicated by the intimate association of lead with zinc and silver in nature. The production and price of these two metals has a distinct bearing on developments in lead. Phenomenally low prices for silver and zinc have discouraged the mining of complex ores containing those metals. It is also quite probable that the miners tended to favor high-lead ores over those of the other non-ferrous metals, where they had any choice. On the other hand, the disheartening drop in all metals caused many a small mine to cease operating entirely. This was evident throughout the year as, one by one, lead-mining enterprises in Montana, Utah, Idaho, Colorado, and Missouri either curtailed heavily or abandoned work entirely.

World Production of Pig Lead

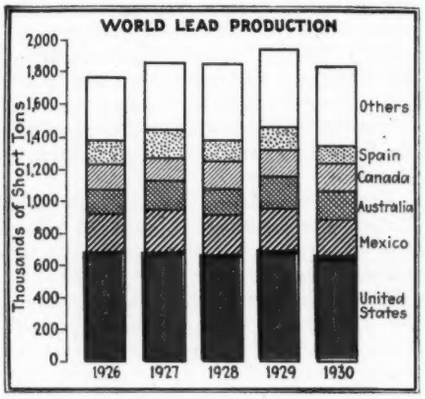
(In Short Tons)

	1928	1929	1930
United States	649,800	688,000	605,000
Canada	170,300	159,200	160,000
Mexico	260,700	274,300	267,000
North America	1,080,800	1,121,500	1,032,000
Australia	174,900	194,700	183,000
Spain and Tunis	156,000	167,000	106,000
Germany	95,900	107,900	126,000
Burma	87,800	89,900	89,000
Others	244,600	254,100	294,000
Totals	1,840,000	1,935,100	1,830,000
Average New York lead price, cents per pound	6.305	6.833	5.517

The natural tendency to decrease production with declining prices gathered strength throughout 1930, and at its close production had declined to such an extent that it was brought down near the rate of 1923, about 40,000 tons per month. Unless the world has decided permanently to get along with a much smaller amount of lead than it has been demanding of late years, the present low rate of production is not likely to continue for many months. The price of lead today should tend to increase its use, except where it comes into competition with its sister metals, copper and zinc, where the same influence is at work.

The long-heralded new supply of lead from Australia will make its appearance in 1931, namely lead from the Mount Isa properties in Queensland. Although lead from Mount Isa will not make its presence felt until the year is well along, it is anticipated that about 5,000 tons per month will ultimately be marketed from this low-cost venture. With the exception of an increased supply of lead from Peru, there are no other noteworthy prospective additions to world lead resources. However, in these days of temporarily saturated markets no one seems perturbed over a possible future shortage of lead.

Selective flotation continues to be a wonderful technical medium for



enlarging the world lead supply, or keeping it at a high rate of output, but there is some indication from available statistics that the full force of this revolution in concentrating methods has been spent. Data of the American Bureau of Metal Statistics show that the production of flotation concentrates made an extraordinarily rapid rise from 1921 to 1928, but that the curve is now flattening. In fact, statistics for Mexico show an actual decline in the total flotation recovery, whereas total lead output has grown.

The domestic consumption of lead in 1930 was good in some directions, such as cable and ammunition manufacture, but in others, particularly in the important outlets of storage battery and pigment manufacture, the consumption was disappointing. The result was a rearrangement of the order in which the numerous markets for lead rank in importance. For the first time in history the consumption of new lead in cable manufacture was greater than that used for storage batteries, about 195,000 tons in cable compared with 170,000 tons in batteries. Storage-battery manufacture has set the pace since 1923 and now yields first place to its close rival in point of lead consumed. This is not necessarily a permanent relation. Both outlets should grow more or less irregularly, and it would not be surprising to see the premier position alternate between the two.

As 1930 was an off year in the automobile business, the storage-battery industry naturally felt the force of this business slump. Production of new cars dropped from the record number in 1929 of 5,358,000 cars to 3,500,000 cars in 1930. However, the storage-

battery industry has a great market in the 28,000,000 cars now in existence. The average life of a storage battery is two years (batteries should last longer with care), so that the replacement market is of great moment. In fact, it was so important in 1930 that a record-breaking number of storage batteries were estimated to have been sold for replacement purposes in the fall. Some estimates place the figure at 8,000,000 replacement batteries sold in 1930.

Most of the old batteries replaced find their way to secondary smelting establishments, there to be converted into secondary lead suitable for use again in the battery business. Probably 150,000 tons of this lead is circulating in the battery industry.

The lead pigment industries had a poor year in 1930. White lead production, dry and in oil, declined from 158,000 tons in 1929 to 120,000 tons in 1930. The output of litharge in 1930 amounted to approximately 74,000 tons, compared with 86,000 tons in 1929, showing the effect of the decline in the battery business. Red-lead production dropped from 44,000 tons in 1929 to 34,000 tons in 1930.

Per Capita Lead Consumption

In Pounds

Year	United States	Great Britain	Germany	France
1912.....	8.79	9.47	7.71	5.81
1913.....	8.75	8.38	7.57	5.86
1925.....	11.96	12.51	6.72	4.93
1926.....	12.98	12.30	5.28	4.87
1927.....	11.79	13.02	7.74	3.87
1928.....	11.78	11.73	7.38	5.52
1929.....	12.05	13.06	7.19	5.56

The world seems to be suffering from a glut of raw materials, mineral and agricultural. The situation is no doubt better in lead than it is in some other commodities, such as copper and wheat, for which statistics show unusually large accumulations of unconsumed production; but that is small comfort in a world lead situation that is undeniably unsatisfactory. It seems odd that there should be a glut of lead. Per capita figures of world consumption indicate that the United States, Great Britan, and Germany have not been increasing their use of lead at an unusually heavy rate in the past five years. In fact, the United States consumption per capita would be considerably better if lead were as extensively used in this country as it is in England for building construction, flashing, roofing, and gutters.

The average price for lead at New York in 1930 was unchanged at 6.25c. a pound during January and all but the last two days of February. The average monthly price dropped steadily to 5.25c. in July, rose to 5.50c. in September, and dropped again to a low for the year of 5.10c. in November and December. The price held at 5.10c. from Oct. 10 to the end of the year.

Asbestos

NORMAN R. FISHER

OWING to the peculiar nature of the uses of asbestos, either in the raw or the manufactured state, the current demand for it by regular or new customers reflects to an exceptional degree the condition of business and industry in general within any particular area or country.

Consequently, hand in hand with the great activity and expansion of industry that has prevailed during recent times within some countries, and particularly the United States, the demand for asbestos has grown enormously, until, in 1929, it became the greatest for all time, amounting to 463,290 tons, valued at $28,995,366, compared with the previous record of 391,599 tons, valued at $23,187,915, made the year before, 1928, or an increase of 19.31 per cent in tonnage, 25.04 per cent in total value, and 5.69 per cent in average value.

Conversely, when the severe industrial depression set in in the fall of 1929, it was almost immediately reflected in decreased sales of asbestos, with a concomitant lowering of prices, to such an extent that world shipments for 1930 are estimated to have amounted to only about 375,000 tons, having a value of about $23,040,000, or a reduction from 1929 of about 19 per cent in tonnage, 20.55 per cent in total value, and 1.83 per cent in average value.

Canada, which, as usual, supplied the larger part of this, doing so to the extent of about 64.77 per cent of the tonnage, compared with 66.06 per cent in 1929 and 84.06 per cent a decade ago, was the greatest sufferer because of the industrial distress existing, particularly in the United States, its chief market. Her sales in 1930 are estimated to have amounted to only about 243,000 tons, having a total value of approximately $8,980,000 and an average value of $36.95, as against 306,055 tons, of a total value of $13,172,590 and an average value of $43.04 in 1929, or a reduction of 20.57 per cent in tonnage, 31.83 per cent in total value, and 14.15 per cent in average value.

The appreciable drop in the average price of the 1930 output of Canada resulted mainly from the reduction in the price of the longer higher-priced fibers, for the decrease in the average price of the remainder, which formed about 85 per cent of Canada's shipments, was only about 4.37 per cent and mainly because it was already unduly low, owing to the keen competition among Canadian producers themselves in the marketing of this class of asbestos.

Rhodesia's asbestos-mining industry was more fortunate, in that its principal market is in Europe, where conditions, though subnormal, were much more stable throughout 1930 than they were in America. Judging from figures now available, its output in 1930 was about 40,110 tons, of a total value of about $5,547,300, as against 42,634 tons, of a total value of $5,767,009, in 1929, or a decrease of only 5.92 per cent in tonnage and 3.81 per cent in total value. The output of Rhodesia was, however, thus maintained in no small measure at the expense of the producers of its neighbor, the Union of South Africa, for figures available in respect to the 1930 sales of the latter indicate that they have decreased to the extent of about 39.23 per cent in tonnage and 30.57 per cent in total value from those of 1929, which amounted to 33,023 tons, having a total value of $2,416,406.

The asbestos industry of Russia, on the other hand, continued to expand during 1930 in spite of the depressed industrial conditions of the outer world, and preparations are now actively under way to increase its output still further, with the announced intention of ultimately making Russia the dominant factor in the raw asbestos markets of the world. Official information regarding the output of Russia is not regularly published, but judging from what is available, the output for 1930 was appreciably in excess of that of 1929, which amounted to about 56,000 tons, which was, in turn, more than double that of the previous year. In the past, the product of Russia has been for the most part disposed of either to home or near-by European consumers, but steps have already been taken, with an immediate depressing effect on the prices of the longer higher-priced grades of fiber, to break into the United States market, which is the most important of all countries, for it alone absorbs about 60 per cent of the world output.

The asbestos industry of Cyprus, which has gradually expanded within recent years until in 1928 its output amounted to 18,241 tons, a record for all time, now appears to be on the wane, for in 1929 it was only 15,791 tons, or a drop of 13.43 per cent from that of the previous year; figures that are available indicate that the output for 1930 has further decreased by about 40 per cent.

Though Canada still maintains pride of place as the world's chief producer of raw asbestos, her proportion of world sales has been gradually decreasing — a situation that has arisen almost entirely through the rapid growth of the African and the revival of the Russian asbestos industries and the ability of the producers of these two countries to compete successfully with Canada in certain of her old markets.

All three of these countries have immense deposits of asbestos, with com-

bined production facilities for an output far in excess of world demand in the present or near future, and, as a consequence, competition in marketing in the various consuming countries of the world is becoming constantly more keen. As a result, a readjustment of trading connections has been actively in progress for some time, and particularly during 1930.

The ultimate result of such a situation, under existing fiscal and competitive conditions, is not difficult to surmise, for obviously the ability of the producers of any of these countries to survive or win out in any of the present or future raw asbestos markets will be entirely dependent upon their respective production and transportation costs.

Cobalt

G. C. BATEMAN

SOURCES of cobalt ores during 1930 remained the same as in 1929, the chief output being from the cobalt arsenides and arsenosulphides in the silver veins of the cobalt district in Ontario and from the cobalt-copper ores of the Belgian Congo. A small output was also reported from Australia, and in England the metal was recovered in minor quantities in the refining of the nickel-copper matte from Sudbury, Ont.

Although the silver output and, correspondingly, the output of cobalt showed an increase during the first nine months of 1930, compared with production during the same period of 1929, the present low prices for silver and the depletion of the mines indicate a diminishing supply in the future from Ontario sources.

In 1929 and the early part of 1930 a strong demand for cobalt prevailed, particularly from Europe. This demand was accompanied by rising prices, but the general industrial depression affected the metal as it did others, with the result that Ontario production for the first nine months of 1930 showed a severe drop, compared with the corresponding period of 1929. The output of metallic cobalt and metal content of oxides and salts was 474,680 lb., valued at $819,828, for the first nine months of 1930, compared with 703,694 lb., valued at $1,379,830, for the same period of 1929. These figures show a decrease of 33 per cent, but the actual situation was more favorable than indicated, inasmuch as the 1929 production, owing to exceptional conditions, was larger than normal.

Nominal quotations for the ore remain the same. Where payment is made for the silver and a charge is made for the treatment of the ore, cobalt is paid for at the rate of 2c. per unit per pound. On lower-grade silver ores, where the silver is paid for but no charge for treatment is made, cobalt 8 per cent and over is paid for at 3c. per unit per pound. On low silver ores and cobalt 8 per cent and over, with no payment for silver and no treatment charge, cobalt is paid for at approximately 6c. per unit per pound. For high-cobalt ores of this type—that is, over 13 per cent cobalt—special prices are paid. Foreign prices may be somewhat higher, but most of the ore is under contract to the Ontario refinery.

Under normal conditions world consumption of cobalt is about 1,000 tons a year, but a survey of the new uses for the metal that are being developed indicates that this figure will be exceeded in the future. The ceramic industry continues to absorb about 40 per cent of the output, but the uses for cobalt alloys are being enlarged, more particularly through the wider application of such alloys as stellite, cobalt magnet steels, and cobalt-tungsten carbides. Other alloys are being developed that maintain great strength at high temperatures, and new uses are being found for them.

Producers have been able to maintain prices, and the metal is quoted at $2.50 per pound and black oxide at $2.10 per pound.

Aluminum

C. L. MANTELL

NEW applications were found for aluminum in 1930, and its use continued to expand along the applications previously exploited. The high points of the year include the reduction of the domestic producers' price to 23.3c. for 98 to 99 per cent metal during June, and the reduction of the European Cartel price on Oct. 16 from $95 a ton to $85 a ton (about 18c. a pound); the extension of byproducts of bauxite mining and refining, which are developed for thermal insulation use and adsorbents; expanding application of the metal for architectural use, particularly in "modern" structure; sustained progress in heat-treatment and application; further developments and uses for strong alloys; the all-round adaptability of the metal as illustrated in the apparatus of the Aluminum Company of America's research laboratory at New Kensington, Pa., where the metal is applied widely and variously in utilitarian and architectural manners; closer co-ordination of the secondary aluminum industry, and development of better and more effective standards; further extension of aluminum for high-voltage transmission lines; and the growing diversification of outlets for the metal, with resultant decreasing dependence on the automotive industries.

A rough estimate of the distribution of aluminum shows that transportation, including automotive, railway, railroad, air, and marine, accounts for 38 per cent of the aluminum consumption, cable and busbars and electric uses consume about 16 per cent, cooking utensils 16, machinery 8, iron and steel industry 8, non-ferrous foundries and metal manufactures 4, building 3, chemical industry 2, food industry 1, and miscellaneous applications about 4 per cent.

Considerable interest has been shown in the development of the largest structural sections of strong alloys for railroad use, overhead cranes, alloy connecting rods for locomotives, and aluminum tank cars for transportation of chemicals. Abroad, about 75 per cent of the Cartel production in 1921 went to the automotive industries, but only 21 per cent in 1929. This percentage is expected to be even smaller for 1930.

An interesting use of aluminum powder in portland cement, with the addition of lime and a small quantity of soda, has produced a new building material for fireproof construction. The porous concrete is strong and light, with unusual insulating properties. A new British plant augmented production at the end of 1929, and Canadian developments progressed. In general, during the latter half of 1930, the industry, in common with those industries responsible for the production of other nonferrous metals, found output exceeding consumption, with the piling up of metal reserves. Abroad, high copper prices were stimulants to aluminum consumption, with the development, under some conditions, of almost all-aluminum electrical machinery. Lowered copper prices removed some but not all of this stimulus, according to reports from several sources.

For the first half of 1930 Canadian exports of aluminum to Japan were as large as those to the United States. For the entire year, total Canadian exports will be much less than for 1929. Of the total world production, the Aluminum Company of America is estimated to contribute a little more than half, and the Aluminum Cartel, consisting of the British, French, German, and Swiss interests and their controlled plants in other European countries, a little less than half. On the whole, in spite of slowing conditions throughout the year, the aluminum industry has held its own satisfactorily, and the outlook for further expansion in the current year is promising.

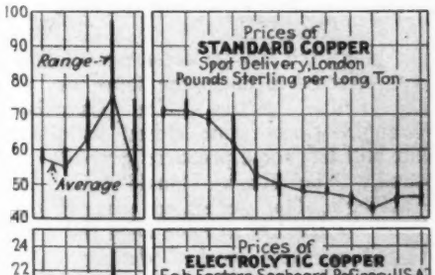
Copper

Arthur Notman

Opposition to Law of Supply and Demand Again Proved Futile

ONCE MORE, in 1930, the copper industry convincingly demonstrated the futility of attempting to set aside the law of supply and demand by maintaining a price level higher than normal in the face of a decline in the general level of business activity and other commodity prices. Such attempts usually give a false impression of success when business is expanding, but they merely serve to accentuate the evils of depression when business is declining.

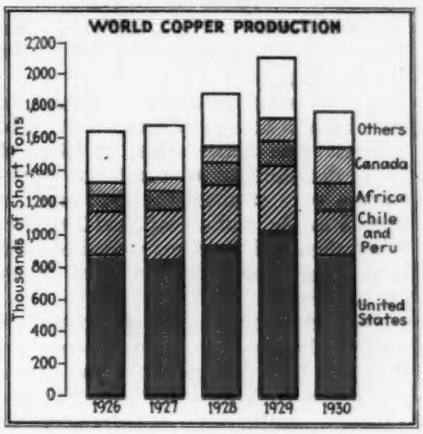
The price of the metal was maintained at 18c. from April, 1929, to April, 1930, in the face of increasing stocks of blister and refined copper. According to the American Bureau of Metal Statistics, these stocks in North and South America, Great Britain, Havre, and Japan amounted to 313,895 short tons on April 1, 1929, whereas on April 1, 1930, these same stocks had increased to 547,593 tons.



In April, 1930, the price broke sharply to 14c., and it slumped more gradually during the succeeding six months, until the average *Engineering and Mining Journal* quotation declined to 9.597c. per pound for October. Stocks continued to increase until, on Nov. 1, they were about 620,000 tons, and, on Dec. 1, were some 11,000 tons lower. World production averaged 148,384 tons per month for the first ten months of 1930, as compared with 178,034 tons in 1929 and 159,706 tons in 1928 and a maximum of 196,820 tons in April, 1929. Announcement of further curtailment of leading producers early in November this year brought the price up sharply to 12c. domestic, only to be followed by repeated slumping to 10c. on Dec. 15.

Some of the effects of these kaleidoscopic changes on the stability of the economic aspects of the industry may be noted in the two tables on this page, which bring up to date the statistics presented in the two tables that accompanied my article in this same issue of last year.

The net working capital of this group of companies stood at about $225,000,000 at the end of 1924. At the end of 1929 it had reached $335,000,000. Some decrease, rather than any further increase, has probably occurred during 1930. However, if we assume no change, the group has paid a total of $647,278,000 in bond interest and dividends since Dec. 31, 1924, and accumulated $130,000,000 additional net working capital. Total earnings for the six years therefore were approximately $777,278,000. The average price received for 13,840,000,000 lb. produced during that period would be, weighted according to the average *Engineering and Mining Journal* quotations for each year, about 14.45c. per pound and the earnings 5.25c. per pound, so that the calculated average costs were about 9.2c. per pound. In a similar manner the average costs in 1928 reached a low since the war of 8.2c. per pound. They may be



expected to reach that figure again, even on the present volume of business, after a period of adjustment to the existing level of activity. If we correct the calculated average price received on account of the increase in stocks of unsold metal during 1929 and 1930, and figure these increases at 10½c. per pound instead of 18.11c. and 12.25c., respectively, the resultant average price is 14.13c.

A similar adjustment of the metal inventory item in net working capital would probably reduce the apparent gain in the latter figure proportionately,

Tables I and II—Output and Financial Statistics for North and South American Copper Companies Producing 65 Per Cent of World Total

Table I

Year	Production, Pounds (000 Omitted)	Bond Interest and Dividends Paid (000 Omitted)	Cents per Pound	Price	Percentage of Average Selling Price per Pound Paid Out
1924	1,923,200	$49,000	2.55	13.02	19.6
1925	2,029,900	64,090	3.18	14.04	22.6
1926	2,112,500	75,040	3.55	13.86	25.7
1927	2,142,400	82,560	3.85	12.92	29.8
1928	2,491,600	94,910	3.81	14.57	26.8
1929	2,773,521	168,978	6.09	18.11	33.6
1930, estimated	2,290,000	112,700	4.92	12.25	40.0
Current rate, estimated	2,184,000	63,800	2.92	10.5	28.5

Note—The 1930 figures on production are estimated on the basis of the American Bureau of Meta Statistics for the world production for the first ten months and on the assumption that this group of companie is responsible for 65 per cent thereof. Bond interest and dividends paid out have been computed from such public statements as have been available to date. The price figure is also an estimate. Similar considerations apply to the figures for the current rate.

Table II

Year	Market Value Closing Quotations Each Year (000 Omitted)	Average Yield on Market Values, Per Cent	Market Value per Pound of Annua Production, Cents
1924	$1,159,000	4.2	60
1925	1,142,000	5.6	58
1926	1,140,000	6.6	54
1927	1,435,000	5.6	67
1928	2,439,000	3.9	98
1929	1,853,912	9.1	67
1930	809,136	13.9	36
Current rate	809,136	7.9	37
1929 highs (March)	3,351,529	4.8	118

Note—Market values are based on closing quotations for each year on all outstanding securities of the group, corrected for duplications. The market value for 1930 and the current rate were taken at the closing quotations for Dec. 10, 1930.

so that our calculated earnings over the six years would also be lower. The cost, however, should be effected little, if any. Reference should be made here to the fact that, aside from the sale of additional common stock of the Anaconda company in 1929 and the retirement of the first mortgage bonds of that company with the proceeds, no additions were made to the net working capital of the group, excepting from earnings during the period. This transaction apparently had no significant effect on the working capital of the group.

The situation, as a whole, appears to have been as follows: Current volume of business was about equal to that of 1925; distributions to bond and stockholders were at about the 1925 level; a price 3 to 3½c. and a cost level 2 to 2½c. below the 1925 averages prevailed; the latter figure should tend toward 3c. in the near future.

The danger of competition from other metals, which was great with copper at 18c., has been reduced to a minimum, and the outlook for expansion of consumption with any improvement in general business is bright. As pointed out in these pages a year ago, the paramount need for the future is an assured expansion of consumption to absorb idle capacity of existing mines and plants and the new supplies of metal from Canada and Africa that will enter the market in volume in the near future. The history of the industry lends weight to the argument that a low price level is the best possible incentive to increased consumption.

Further progress was made during 1930 in the vertical integration of the industry through the acquisition of the Nichols Copper Company and the National Electric Products Company by the Phelps Dodge Corporation. Three new refineries have been put into operation, two in Canada, at Sudbury, Ont., and Montreal, Que., and one in the United States, at El Paso, Tex. The operations of the Union Minière du Haut-Katanga, in the Belgian Congo, were expanded to a new peak of production at 151,000 tons, and developments continued favorable in the Northern Rhodesian field adjoining the Congo. Canadian production reached a new monthly peak at 12,850 tons in August, the total for the year being 113,004 tons, compared with 121,151 tons in 1929 and 96,634 tons in 1928.

World production of copper, on the basis of fine copper content of blister copper, was reported by the American Bureau of Metal Statistics as 1,769,635 short tons, compared with 2,104,110 tons in 1929. Of this total for 1930, United States contributed 820,000 tons, Mexico 58,535 tons, Chile and Peru 280,554 tons, Japan 87,924 tons, Australia 14,658 tons, Germany 65,060 tons, and Europe, exclusive of Germany, 152,900 tons.

Graphite

BENJAMIN L. MILLER

WITH its international character, the entire graphite industry was affected adversely to a marked degree by the world-wide depression of 1930. Inasmuch as graphite is used principally in the manufacture of crucibles for the melting of metals and in foundry facings, the slump in the metallic manufacturing industry necessarily produced a decided curtailment of graphite sales. With almost unlimited deposits of graphite in various countries of the world, and facilities to prepare for market quantities far in excess of the normal or even excessive demands, no escape has been available from ruinous competition during periods of decreased demand.

The domestic producers of flake graphite have long realized this situation and have worked incessantly for higher tariff rates. They have repeatedly argued that domestic graphite flake could be substituted for the imported crystalline product (a statement that is denied by the users of graphite) and that no reason exists why the domestic industry should not be protected by a tariff that would enable the domestic producers to compete with the foreign countries that supply most of the graphite consumed in this country. They point to such figures as those for 1929, where the domestic production was 5,805,336 lb. and the imports of crystalline graphite were 23,951,313 lb.

Accordingly they fought vigorously for heavy tariff rates in 1922, but were disappointed when the act was finally passed with the following rates: amorphous, 10 per cent ad valorem; lump, chip, and dust, 20 per cent ad valorem; crystalline flake, 1½c. per pound. With these rates, only a few of the flake graphite companies in Alabama and Texas continued to operate their plants, and these experienced difficulty. Occasionally a company in New Jersey, California, and Montana opened its mine for a short time.

With the enactment of a new tariff bill, the operators again made strenuous efforts to have the 1922 rates materially increased, but with the passage of the Tariff Act of 1930 they met defeat. This act provides the following rates: amorphous, 10 per cent ad valorem; crystalline lump, chip, or dust, 30 per cent ad valorem; crystalline flake, 1.65c. per pound. The increases were too small to be of substantial assistance, and the effect during the latter part of 1930 has been disastrous. Some operators believe that they can still compete with foreign producers, but a growing belief prevails that the crystalline graphite industry of the United States is now practically dead.

The Southwestern Consolidated Graphite Company, operating mines at Burnet, Tex., and Hollins, Ala., closed its plants at the end of 1929 and has no plans for resuming. This company was for years the principal domestic producer. It attributes its inability to continue to the lack of a sufficient protective tariff and the great decline in the dry-battery industry. Two Alabama graphite companies operated during part of 1930—namely the Bama Graphite Company, Mountain Creek, Chilton County, and the Superior Flake Graphite Company, Ashland, Clay County. The mill of the former burned late in the year, and the latter closed down but may reopen. The Consolidated Graphite Corporation has recently been organized and taken over the properties of the Alabama Quenalda Graphite Company. It plans to begin operations shortly.

The plant at Annandale, in New Jersey, was idle during the year, except for research investigations. Only a few tons of ore were taken out of the Dillon, Mont., mine.

Among the domestic amorphous graphite producers few changes took place during 1930. Foundry facing graphite was produced at Providence, R. I., on a small scale; the Baraga, Mich., mine was not worked, as the company which utilizes the product in the manufacture of paint had a sufficient supply on hand from the previous year; and the Carson, Nev., concern appears to have operated about as in former years.

Among the foreign countries, Canada was affected in much the same way as the United States. The Canadian Graphite Corporation closed its plant, but still has some prepared graphite on hand. The Black Donald mine, at Calabogie, Ont., operated part of the year. It appears to have been the only Canadian plant worked during 1930. Production of Mexican amorphous graphite was slightly reduced.

Conditions in Ceylon remained unsatisfactory, and 1930 will undoubtedly show considerably reduced production. Some of the Ceylon operators doubt whether they can continue unless prices increase markedly. A general combination or working agreement, by which internal competition would be decreased, has been recommended. Madagascar still wields the whip hand, and Ceylon, as well as the other countries producing crystalline graphite, find the competition serious. Mergers of smaller companies are taking place there, to the advantage of the industry.

Korean (Chosen) amorphous graphite production was about normal in 1930. The final figures for the year will probably show an importation in the United States of 1,600 to 1,800 tons.

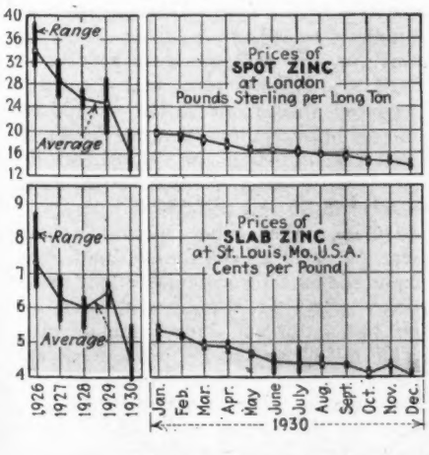
Zinc

Julian D. Conover

Consumption Declines Markedly, Particularly in the United States

THE economic depression of 1930 saw a falling off in the world's consumption of zinc, which was particularly marked in the United States. Demand was affected by the slowing down of building and construction work, in which large quantities of zinc-coated (galvanized) materials, brass products, sheet zinc, and zinc paints are normally absorbed, and by the depressed condition of agriculture, which reacted unfavorably upon the sale of galvanized sheets. The world-wide character of the depression was reflected in the sharp decline in exports of galvanized sheets from both the United States and Great Britain—a considerable factor in this loss of trade being the Far Eastern silver crisis, which drastically reduced the purchases of such products by India.

World production of zinc, which in each of the six preceding years has attained a new high record, fell off in



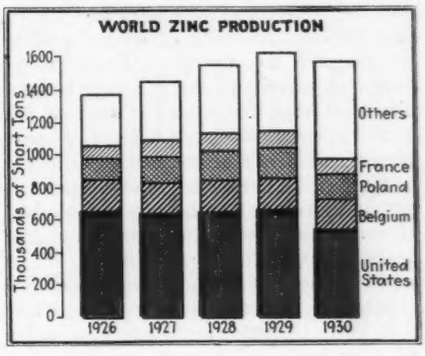
1930 to the 1928 level of 1,565,000 tons or possibly still lower, but was not reduced sufficiently to balance the lower rate of consumption, and unsold stocks mounted steadily throughout the year. Estimates of the International Metal Service indicate that total world stocks, which at the beginning of the year had increased to 130,000 tons, continued to grow to 252,000 tons on Dec. 31. These figures included American stocks of 74,400 tons on Jan. 1, 1930, and 143,600 tons at the close of the year.

Naturally, the continued oversupply of zinc caused a weakening of the price structure. The London price, which started the year at approximately £20, declined steadily, until in December it touched a figure of £13 5s., closing the year slightly above this level. At the low point the price was equal to the low record for all time, established in 1885, and was equivalent to only 2.87c. per pound in the United States (leaving ocean freights and import tariffs out of consideration). The St. Louis price declined from 5.45c. at the outset of the year to a low point of 3.95c. in October, and closed the year at 4.125c.

Of the principal slab-zinc producing countries, the United States continues to hold a dominant position, though with production curtailed from 632,000 tons in 1929 to 504,000 tons in 1930, its proportion of the world total shrank to approximately 35 per cent. The two leading European producers, Belgium and Poland, discontinued the release of production statistics in 1930; definite information as to their output is therefore not available, though unofficial estimates indicate some curtailment from the 1929 total of 407,000 tons. Most of the other zinc-producing countries showed little or no reduction of output, and, in fact, their aggregate production increased about 60,000 tons, or 10 per cent above their 1929 output.

Canada in 1930 became the fourth largest producer of slab zinc, providing about 8 per cent of the total and surpassing both Germany and France, which produced at practically the same rate as in 1929. The increased Canadian output was largely from the Sullivan mine, in British Columbia, for which enlarged mill and electrolytic plant capacities were provided, as well as a plant to recover zinc from the lead smelter slag. Production in that country will be further increased by the Flin Flon plant, in northern Manitoba, which was placed in operation late in the year. In eastern Canada, however, the projected construction of another electrolytic plant has been held in abeyance, and a number of mines, finding it unprofitable to continue shipment of their zinc concentrates to Europe, have shut down. The Buchans mine, in Newfoundland, continued to make large-scale shipments of zinc concentrate and announced plans for doubling its mill capacity.

As a result of decreased output in England, Australia surpassed that country and ranked seventh in 1930 slab-zinc production. The management of the electrolytic plant at Risdon, Tasmania, suspended its plans for further enlarging the output of metal, and postponed the opening of its Tasmanian zinc mines, for which a new mill had been completed. The long-term British con-



tracts for Broken Hill zinc concentrates, which had been equivalent to a subsidy to these mines, expired on June 30, and two of the four large mines then discontinued recovery of zinc from their ores. It was expected that a large accumulated stock of concentrates would be reduced through shipment to European smelters and to the Risdon plant. Production from the immense Mount Isa lead-zinc mine, in Queensland, is expected to start some time in 1931, but at the Lake George mine, in New South Wales, building of a mill has been deferred until metal markets improve.

A large electrolytic zinc plant in Norway, owned by a French company and supplied with ore largely from its mines in Spain, was started late in 1929 and produced throughout 1930. The smaller European slab-zinc producing countries —Netherlands, Italy, Czechoslovakia, Yugoslavia, Sweden, and Russia—together account for about 5 per cent of the world's total, and the remaining 5 per cent comes from Japan, Mexico, Rhodesia, and Indo-China. In Yugoslavia an important lead-zinc mine was placed in operation during the year. The Soviet government announced ambitious development plans for the exploitation of Russia's large zinc-ore resources, including one retort-type zinc smelter, recently completed, and another such plant and three electrolytic zinc plants in prospect.

Production of zinc concentrates in Mexico, only a minor portion of which is smelted within that country, was curtailed in 1930 to some extent by the low price of lead, zinc, and silver, and plans for an electrolytic zinc plant at Laredo were abandoned. In South America, Peru, Bolivia, and Argentina are all potential large producers of zinc from mixed ores, with electrolytic zinc

production at the Cerro de Pasco properties, in Peru, definitely in prospect when conditions improve. Limited amounts of zinc concentrates from these countries have been shipped to Europe.

During 1930 negotiations were actively carried on for a revival of the European Zinc Cartel, with the purpose of regulating production and thereby stabilizing prices. An organization of wide scope was contemplated, including not only European producers of slab zinc but also those in Australia, Canada, and Mexico, the bulk of whose product is shipped to Europe. Considerable progress was made, but it finally became apparent that the quota claims of the various countries and individual producers could not be reconciled, and the project was abandoned. Curtailment of output therefore is to be expected mainly through the forced closing of mines and reduced operations or shutdown of smelters dependent upon purchased ore supplies—a process already in evidence.

In the United States the low price of zinc and inability of producers to dispose of their entire production resulted in a considerably lower rate of output in the latter months of 1930. Production fell to or even below the level of the subnormal consumption; and this, together with the fact that consumers were carrying low stocks and were largely underbought for future deliveries, created a much stronger statistical situation.

Of the zinc-mining districts of the United States, the Tri-State district continued to hold first rank, producing about 40 per cent of the country's total. An average of 72 mills, including 21 tailing mills, operated during 1930, compared with an average of 114 mills in the previous year, but the average production per mill was considerably higher. The price of zinc concentrates declined from $37 to $26 per ton, a figure at which many mines were forced to shut down, and many of those which continued to operate did so at little profit and in large part to give employment to their men. Costs of operation were substantially reduced and metallurgical efficiencies improved.

Western miners of complex ores were adversely affected by the low prices of lead, silver, and zinc, and production both at Western mines and at the electrolytic zinc plants of the Northwest was greatly reduced. Important properties which discontinued all production included the Sunnyside, in Colorado; the zinc concentrators of the Anaconda company; the Butte & Superior and the Block P mines, in Montana; the Star mine, in Idaho; and the Utah-Apex, in Utah. Many other properties curtailed their production materially. Large additional reserves were developed at Pioche, Nev., which gives promise of becoming one of the important zinc-producing districts of the country. Active development of the United Verde's zinc reserves in Arizona will probably await better prices.

In the Appalachian region, important new zinc mines were brought into production in New York by the St. Joseph Lead Company and in Tennessee by a U. S. Steel Corporation subsidiary.

Technical developments of the year include refinements in mill practice, particularly in selective flotation, which today is responsible for half of the world zinc output. In zinc smelting, three of the new vertical retort plants have been in successful operation, producing a high grade of metal by continuous distillation. New electrolytic plants have been placed in operation or are under construction in Canada, Poland, and Germany, and others are projected as previously noted. The proportion of the world zinc produced by the electrolytic process is steadily growing, being now over one-fourth of the total. Low prices have forced improvements and cost reductions in both electrolytic and distillation plants.

An electrothermic process capable of producing either slab zinc or zinc oxide will be employed by the St. Joseph Lead Company at a new plant being completed in the Pittsburgh district.

In appraising the future of zinc, it must be remembered that some of its principal fields of usefulness are as a constituent of other semi-finished materials, such as galvanized steel and brass. Galvanizing accounts for 40 to 45 per cent of the entire consumption of zinc, and, although this use has not shown any appreciable expansion in recent years, its possibilities are great. The ordinary consumer of galvanized roofing sheets, for example, has no realization that their protective coating consists of zinc, nor of the superior service which can be obtained with a moderately heavy coating, as compared with the thin zinc coatings usually supplied. The educating of consumers to these facts and the making available to them of heavier zinc-coated products would do much to broaden the market for both zinc and steel.

In the pigment field, zinc oxide and lithopone have established themselves firmly, their merits being attested by the steadily increasing consumption. Zinc dust, which makes an excellent priming paint for iron and steel, has not received the attention it merits. The recent development of zinc-base die-castings has opened up a large field to which zinc is particularly adapted, and which has excellent possibilities of further development.

With production, at least in the United States, no longer exceeding consumption, and with zinc in its various forms entering into a great number of essential materials, conditions in the zinc industry will undoubtedly improve with a revival in general business.

Nickel

THOMAS W. GIBSON

PROSPECTS were bright for the nickel-mining industry at the beginning of 1930, but when the price of copper fell in April from 18 to 14c. per pound the sky became overcast and the clouds grew thicker and darker as copper continued in its headlong and downward career. Why this should affect nickel mining is explained by the fact that the ores at Sudbury, Ontario, carry copper as well as nickel; the Frood mine of the International Nickel Company, with its huge masses of rich ore, is essentially a copper mine, though carrying also the normal proportion of nickel. Consequently, the fortunes of nickel are bound up with those of copper, and the fall in the latter naturally had a serious effect upon the situation. An immense expansion in the company's plant, based largely on production from the Frood property, was completed in 1930 at a cost that was in excess of $30,000,000.

The demand for nickel fell off during 1930, but not until the last quarter of the year was the full effect of the slump in metal prices and general business felt. During the nine months ended Sept. 30, 1930, production showed a decided increase in the quantity of ore raised and smelted and in the matte produced. Metal content of the matte, owing to the treatment of Frood ore, underwent a change, copper increasing from 43 per cent in 1929 to 53 per cent in 1930, with a proportionate lowering of the nickel percentage. The quantity of ore smelted during the nine months' period rose from 1,495,829 tons for the corresponding months of 1929 to 1,779,366 tons, and the matte produced rose from 95,411 to 122,396 tons. Nickel content of matte increased from 86,244,148 lb. to 91,581,560 lb., and the copper content rose from 64,699,643 lb. to 102,333,453 lb.

During the nine months ended Sept. 30, 1930, 27,808 tons of matte was exported, part for refining at the company's plant in Wales, and part for the production of Monel metal, malleable nickel, and nickel products at the company's works at Huntington, W. Va. The quantity of matte treated in Ontario for the period was 113,607 tons, the products being metallic nickel, converter copper, and nickel oxide.

Nickel continued to be produced in New Caledonia, but the output was small, compared with that of Sudbury, in 1930. Until the end of September, 1930, matte produced and shipped to Europe amounted to 4,641,558 kg. Of this the Société Calédonia produced 1,384,808 kg., and the Société de Nickel, 904,325 kg.

Iron

Edwin C. Eckel

Carryover From Year Before Reduces Ore Sales to a Minimum

OUTPUT at iron furnaces in the different countries dropped steadily as the year 1930 advanced, the bases reached ranging from 90 to 50 per cent of the national totals made during 1928 and 1929. A year ago, facing the coming depression, the carryover of iron ore at mines, ports, and furnaces was noted to be what was probably the largest tonnage in history. That fact weighed heavily on most ore markets, and reduced fresh commitments to a minimum. At some points tonnages already "purchased" were allowed to stay at mine or port. So that for 1930 the differences between tonnages mined, shipped, and smelted were even greater than might have been expected; and regional statistics must be examined with more than usual caution. In many regions, notably in north Sweden and west France, the "magazine" system of mining has led to the carrying of enormous tonnages of mined ore in the mine itself, and these heavy supplies do not appear in ordinary reports. At other mines, as for example Wabana, Lorraine, and the Spanish operations, practically the entire carryover is on the surface in clearly visible stockpiles and ore pockets. The manner in which the depression affected the different countries, both as to timing and extent, is indicated in the accompanying table:

Record of Pig-Iron Output, Showing Effects of Depression

Country	Month	Maximum Output Metric Tons	Output in Aug., 1930, Metric Tons	Decrease, Per Cent
United States	July, 192[illegible]	3,785,000	2,567,000	33
Germany....	July, 1929	1,204,000	739,000	38
France.....	Jan., 1929	905,000	860,000	6
Russia.....	May, 1930	447,000	(a) 428,000	5
Great Britian	Aug., 1929	682,000	417,000	39
Belgium.....	Jan., 1929	351,000	247,000	30
Luxembourg.	Aug., 1929	251,000	(b) 178,000	29

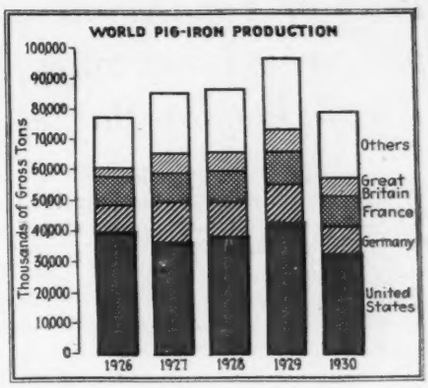
(a) Output in July, 1930 (b) Output in June, 1930.

As usual during a period of financial stress, more careful ore buying on the part of furnace interests operated sharply in favor of the low-cost ore producer, whether entire districts or individual mines. In the United States the Alabama red-ore mines probably showed less decrease than any of the other ore fields. And of the mines supplying European markets, such operations as Wabana, in Newfoundland; Segré, in Anjou; and the scattered merchant mines in Normandy, all showed in 1930 either slight decreases or increases, compared with their 1929 outputs, whereas production at the higher-cost Spanish, Algerian, and similar mines decreased markedly.

Any world monopoly in iron ores was recognized many years ago as not being feasible economically, but the suggestion was made that all the real profits of a complete monopoly could be secured by any corporation or group that controlled not the bulk of the reserves but the best of the reserves. Reference is made now to that viewpoint and suggestion merely because apparently such a monopoly, in so far as ores reaching Atlantic Basin markets are concerned, has received serious consideration in recent years and is well on its way to being an accomplished fact. Control will evidently be non-American and non-British. In its American effects, such an Atlantic control would ultimately affect only the few furnaces and mills that are situated on or near the Atlantic seaboard.

But for the bulk of the British iron industry the results might be more serious, inasmuch as the slow but apparently final decline in the Spanish reserves leaves British mills with no control over the European and African ores, which must be bought to replace former supplies. Therefore, in any real recovery in the British iron trade, furnaces there will probably be supplied not merely by foreigners but by foreign steel competitors. A result of broader importance is that in the future iron mines are likely to make more money and steel works a little less.

Aside from the preceding, developments which seem likely to bulk most importantly in future years are Russian, and consist merely of the steady progress, despite most serious financial and political obstacles, of the Soviet industrial program. This has been largely discussed in America for various reasons, and the discussion has been neither clear nor conclusive. The cold truth, which might as well be faced once in a while, is that the whole Soviet future is entirely incalculable to anyone thinking in terms of a basically different economy. If the Soviet iron and steel program is studied, for example, on the theory that it were to be operated for profit by an ordinary corporation, criticism of the raw materials, mill locations, products made, and tonnages planned might be easily possible, as well as a demonstration that it would be an unprofitable enterprise and one entirely unimportant to other countries. But when we realize that these Soviet mills will never lack labor, that they have no bond interest, no bonuses, and that they do not have



to make cash profits, we will realize also that within a decade these mills may become serious competitors of those in east Germany, Poland, and Czechoslovakia, with far reaching industrial and political consequences.

As pointing these remarks it may be noted that the average monthly output of pig iron in Russia was only 203,000 metric tons in 1926; that it rose to 259,000 monthly in 1927, to 279,000 in 1928, to 358,000 in 1929. During the first half of 1930 the average monthly iron output of the Soviets was 427,000 tons; its current decrease is slight. In 1926 Russia ranked seventh as an iron producer; today the Soviet output is greater than that of England and almost double that of Belgium; more than double that of Luxembourg. At the close of 1930 Soviet Russia ranks fourth, following United States, Germany, and France. The Czarist government, with all its easily secured foreign capital, was unable even to approximate that rank.

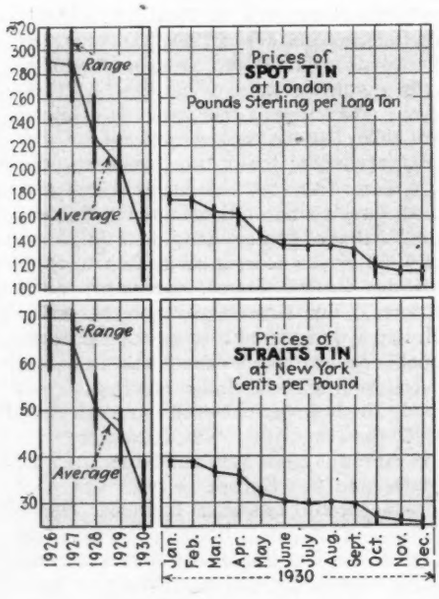
In America, the Lake ore region is likely to show better results in 1931 and 1932 than in 1930. The situation for the Atlantic coast region of the United States and for Europe is not clear. A fundamentally unsound financial Germany; a Great Britain facing a choice between lost trade and lowered living standards; and a growing profitless Russian competition, all suggest that European recovery from the collapse will be slow and painful, with possible repercussions on American Atlantic Coast trade. Strengthening of ore reserves and markets in the central United States, on the part of American steel companies, would seem advisable; and for tariff reasons a Canadian foothold may appeal to farseeing corporations.

Tin

E. Baliol Scott

Price of Tin Declines to Lowest Level Since 1902 in London Market

FOR the tin industry, the year 1930 was a difficult one; in December cash Standard touched £104½, the lowest price recorded in London since 1902. The decline was progressive throughout 1930, as indicated in the accompanying chart. Outstanding factors contributing to this price record were: (1) the decline in consumption, especially in the United States; (2) the ability of producers to adapt operations to falling prices. At the beginning of the year the importance of these two factors was not commonly recognized, and general opinion regarding them was such that it unduly favored keeping up the price. The statistical position at that time is now known to have been much worse than it appeared to be. Moreover, large deliveries characterized American statistics as late as March, and American trade, instead of showing the predicted improvement in the second half of the year, declined further. In spite of a substantial reduction in output during the year, visible stocks therefore have increased heavily since the end of 1929. Up to the present time no evidence of a decline in these stocks, an essential preliminary to any improvement in outlook, has become apparent.



At the end of October, according to statistics published in *The Mining Journal*, of London, the total visible supply was 39,169 tons, the carry-over in the Straits 5,596 tons, and the stock in Banka reported to be about 5,000 tons, making total stocks about 50,000 tons, as compared with 32,449 tons reported at the end of 1929, in which report, however, no allowance was made for Banka stock. These totals, although not strictly comparable, reveal that a large increase has occurred since the beginning of the year.

Decline in production for the first eleven months was about 14,000 tons, as shown in the accompanying table.

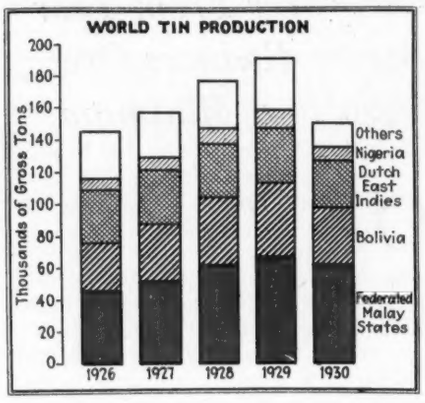
Production of Tin, First Eleven Months, 1929 and 1930

In Long Tons

	1930	1929	Change
Federated Malay States	57,043	61,193	—4,150
Banka	10,548	12,202	—1,654
Dutch ores to the Straits	17,037	19,367	—2,330
Siamese, Indian, and African ores to the Straits	13,114	12,337	+ 777
Nigeria	8,201	9,745	—1,544
Bolivia	33,665	39,078	—5,413
Totals	139,608	153,922	—14,314

The actual decline was probably still greater, inasmuch as the smaller producers undoubtedly suffered far more than the larger operators. In Cornwall, the mines experienced several setbacks early in the year and subsequently closed down entirely. Producers in Australia, Spain, and Portugal were proably not in a much better position.

In January, 1930, certain restrictive measures were adopted by some of the London companies in the Federated Malay States, co-operating with the Tin Producers' Association on the basis of 32 hours' shutdown every week. How widely the scheme was adopted is difficult to ascertain, but results were quite unsatisfactory. In March a curtailment to 80 per cent of the 1929 output was suggested and indorsed by a majority of the association's member in Malaya, Siam, Nigeria, and Bolivia. Chinese producers, in the East, and the Dutch mines of Banka did nothing; Billiton undertook a 5 per cent cut. As this restriction proved inadequate, a two-month holiday for all producers was proposed. This scheme proved unworkable, as Banka and the Chinese producers in the Federated Malay States remained outside, with Bolivia offering a 25 per cent curtailment for the rest of the year, and Billiton one of 20 per cent. This arrangement resulted in a sharp, temporary reduction in most fields. Bolivian shipments, however, became heavy again in September and October, and those from the Federated Malay States recovered markedly in October. The reason for increased shipments from the Pacific Coast in September and October is not apparent, but the holiday was probably used for increased development work, allowing flush production at the resumption of operations. General opinion is that heavy shipments will not continue, and therefore Bolivian production shown in the table may decrease further.



In regard to operations in the Federated Malay States, the impression is that restriction by the London companies will probably be entirely abandoned, particularly as restriction has substantially increased their costs. Concerning the Chinese production, the U. S. Department of Mines reported toward the close of 1930: "There has been no closing down of mines on a large scale notwithstanding the abnormally low price. The manner in which the Chinese miners are fighting against the present adverse conditions is truly remarkable. . . . It is this factor which has falsified the predictions of those who anticipated a wholesale closing down of Chinese mines." As the accompanying table shows, shipments from Siam, Indian, and minor outside sources to the Straits' smelters actually increased during 1930. Therefore the abnormally low prices cannot be said to have restricted production.

Decline in consumption is undoubtedly a more important factor in the tin situation than producers' resistance to abnormally low prices. A feeling prevails that a heavily restrictive price is imminent. Owing to the huge stocks available, a continuation of the present low consumption may easily mean a long period of depressed prices. All interested in tin are, therefore concerned mainly about what course consumption will take during 1931.

The old basis of estimate—deliveries—has become entirely unreliable, and this fact adds to the difficulty of making an analysis. World deliveries, according to the figures of the National Metal Exchange, were 106,783 tons for the first ten months of 1930, compared with 118,687 tons for the same period of 1929, a decline of 11,904 tons. The United States was responsible for more than the entire loss, with a ten months' total of 64,460 tons for 1930, against 76,775 tons for the same period of 1929, a drop of 12,315 tons. With marked falling off of production in the automobile industry, and decreased activity in tin-plate manufacture, the two chief consumers of tin, these delivery figures for 1930 are generally agreed to be much in excess of the tonnage that has been actually smelted.

Recent low prices appear to have tempted American consumers to increase their stocks materially, and purchases have, in one or two instances, been made as far ahead as for the early part of 1932. A reduction lately in the stocks of Standard tin in Great Britain appears to some extent to have been caused by shipments into non-official warehouses in the United States and possibly into consumer's stores on consignment.

In Europe the general depression in industry is such that nobody believes actual consumption to have increased to the extent indicated by deliveries. European stocks should therefore also show an increase. This is confirmed to some extent by individual private reports of accumulations in various ports. The same may be said concerning deliveries to outside sources, which statistics give 6,703 tons for the first ten months, against 6,130 tons for the same period of 1929.

The present outlook, considering the three factors, production, consumption, and world stocks, is anything but cheerful. Efforts to obtain further restriction will certainly continue, although this movement, to some extent, was a failure in 1930. Speaking in general terms, conditions of world trade will determine the trend of the tin market in 1931. If a substantial recovery in business is foreseen, the market will be influenced immediately by speculation, based on prospects. Low prices can hardly fall further without a sharp contraction in output. Most mines have had a long period of losses, and their power of resistance must be greatly impaired. Although a prediction is made with difficulty, a further decline in price early in 1931, followed by a recovery later in the year, may not be a surprising course of events. Whatever the cause may be, the general impression is that the American consumer now, unlike when the Bandoeng pool was in operation, has large stocks of tin on hand.

Sulphur and Pyrites

RAYMOND F. BACON

AS IN THE last fifteen years, the United States was the dominant figure in the world sulphur industry during 1930, both in production and shipments. The other major producing countries in the order of their importance are: Sicily, Continental Italy, Japan, Spain, and Chile. In the United States, Sicily, and Continental Italy production increased, and final statistics will probably show a slight increase in shipments for the other two countries. World production in 1930 was about 2,900,000 tons, an increase of about 100,000 tons over the 1929 total. Shipments are estimated at 2,450,000 tons, as compared with 2,800,000 tons for 1929.

Production in the United States totaled about 2,525,000 tons, or 9 per cent more than the total of 2,362,389 tons mined in 1929. This increase, together with the falling off of shipments, resulted in adding about one-half million tons to stocks on hand at the mines of the producers—a satisfactory condition because, for the five years 1924 to 1928 inclusive, shipments exceeded production and accumulated stocks were drawn on to meet the deficiency. This gain in stocks was brought about mainly by Texas Gulf Sulphur, at Boling Dome, Newgulf, Tex., where operations started in 1929 were continued at an increased rate; shipments from the deposit commenced in August, 1930. Operations started at the same company's properties at Long Point, Tex., in March, 1930, were also successfully continued. Production was maintained at an uninterrupted rate by the company's older plant at Gulf, Matagorda County, Tex.

Freeport Texas Sulphur operated its deposits at Bryan Heights and Hoskins Mound, Tex., continuously throughout 1930, but at a rate slightly less than in 1929. Duval Texas Sulphur, which started operations at Palangana Dome in the fall of 1928, continued to operate at practically its rate of 1929, when about 43,000 tons of sulphur was produced.

Export shipments for 1930 decreased markedly from the total for 1929, and, although domestic shipments for the first nine months about equaled those for the same period of 1929, they declined slightly in the last quarter of the year. Estimated total shipments for 1930 were 2,030,000 tons, a decrease of 17 per cent from the record total of 2,437,238 gross tons shipped in 1929, but a decrease of only about 2½ per cent from the 2,082,924 gross tons shipped in 1928.

The total exports were about 565,000 tons, or 33 per cent less than the 855,183 tons exported in 1929. Shipments to domestic consumers reached an estimated total of 1,465,000 tons, or about 7 per cent less than the 1,582,055 tons reported for 1929. The comparatively small decrease in shipments of sulphur to domestic consumers as compared with the reported falling off in other industries is striking. The great diversity of uses of sulphur contributes to this condition.

Sicily's production for the first five months of 1930 was at the 1929 rate, but increased activity during the summer months resulted in an output of about 245,000 long tons during the year, or slightly more than the 237,000 tons that was produced in 1929. Inasmuch as the practice has not been to accumulate large stocks, shipments will probably reach a total of 230,000 tons, compared with 218,000 tons in 1929.

Continental Italy produced about 88,000 tons in 1930, an increase of 20 per cent over the previous year's record. Shipments were about 75,000 tons, as compared with 65,000 tons in 1929.

Japan is reported to have shut down some of its mines, so that production is not expected to equal the 75,000 tons mined in 1929. Shipments were about 60,000 tons, a decrease of 20 per cent from the previous year's total.

Production and shipments in Chile are estimated at 10,000 tons for 1930. Although statistics are not available, a total of about 70,000 tons of sulphur ore was probably the output of Spain.

The latest figures available for the world production of pyrite are for the year 1928. Production in 1930, however, was probably less than that in 1929 and will not differ much from the output of 7,000,000 tons in 1927 and 1928.

The United States' imports of pyrites in 1930 are estimated at 390,000 gross tons, a decrease of about 24 per cent from those of 1929. Domestic producers operated throughout 1930, but production probably did not exceed 250,000 tons, compared with 333,465 gross tons in 1929.

In view of present world conditions and the lack of unanimity in thought among economists, to forecast conditions for the sulphur and pyrites industries for 1931 is difficult. The present indications for the sulphur industry in the United States are that domestic shipments in 1931 will remain approximately 1,500,000 tons, and that, with any improvement in the economic situation of foreign countries, an export figure in excess of 600,000 tons may be attained. Production for the new year should not be less than 2,000,000 tons. As none of the other countries accumulates large stocks, production and shipments will probably be equal in those countries, and they should not vary greatly from the 1930 figures.

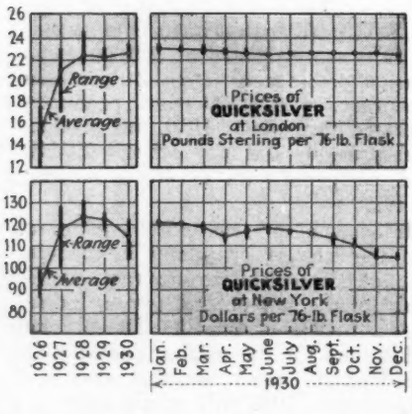
Quicksilver

H. W. Gould

Quotations Undergo Slight Revision With Decrease in Demand

THE ECONOMIC depression, resulting in a decreased demand that first made itself felt in the closing months of 1929, was reflected in the quicksilver market of 1930, though to a lesser extent than in most of the other metal markets. During the year, the price gradually declined from $122, in January, to $104, in December. The London and Lausanne price, however, showed little fluctuation, and the metal was quoted in European markets at about £22 at the close of the year. Consequently, little quicksilver was imported into the United States during 1930—less than 3,000 flasks, as compared with 14,292 flasks in 1929.

Production of quicksilver in the United States decreased markedly in 1930, the output probably not exceeding 19,000 flasks, as compared with 23,682 flasks in 1929. Apparent consumption, that is domestic production



plus imports, plus the difference between bonded warehouse stocks on Jan. 1 and Dec. 31, 1930, was about 25,000 flasks, as compared with an apparent consumption of 37,974 flasks during the preceding year. This decrease in consumption was directly responsible for the decline in price.

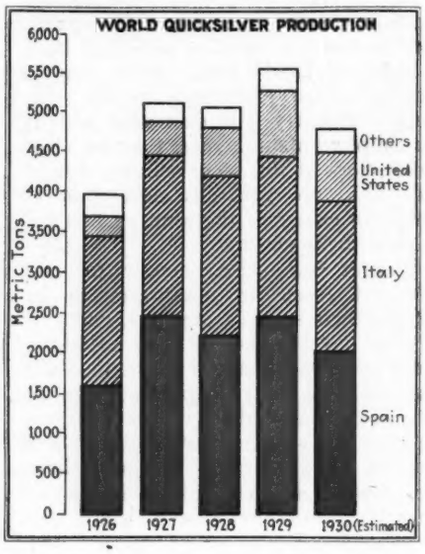
Consumers taking advantage of the necessity of local producers to sell their spot metal for cash, the influence of some small stocks built up early in the year when consumption was about nil, and the fact that American production nearly equaled consumption, were the principal factors in bringing the price down to a lower level.

To estimate the world production of quicksilver in 1930 is difficult; members of the European cartel are reticent regarding figures on production. The output of Italian mines is reported to have been greatly reduced, and the Almaden mine, in Spain, closed down in February, remaining closed until October. What the production policy in either Spain or Italy will be is unknown, though considerable stocks are said to exist, owing to a world-wide decrease in sales. World consumption in 1930 was probably less than 100,000 flasks.

Production of quicksilver in Mexico was low during the early part of 1930, but rehabilitation of the Castro and Huitzuco mines started in the fall. Toward the close of the year the Castro property was producing from 250 to 300 flasks per month.

Generally, new developments in foreign mercury fields were unsatisfactory in 1930. The Kaikohe Development Company, Ltd., in New Zealand (a subsidiary of Imperial Chemical Industries), was reported to have closed down its property after making expenditures totaling nearly a million pounds. The French company operating in Algeria has also been unsuccessful. Yamato Suiginzan Kogyosho, at Osawa, Japan, continued to produce on a small scale throughout the year. Reports from Russia state that the U.S.S.R. expects to develop extensively its state quicksilver properties during 1931; engineers and geologists were sent to the United States in 1930 to study the various mining and reduction methods employed there.

In the United States, the quicksilver industry seemed to suffer principally from the stock-market crash, which closed down some of the companies depending on outside money for development and operation. Production decreased most in Nevada, where the output was about 3,300 flasks, as compared with 4,764 flasks in 1929. The largest producers in the state were the Castle Peak mine, near Virginia City; the B. & B. mine, south of Mina; and the Friedman mine, near Antelope Springs. Oregon production also decreased, owing largely to depletion of ore reserves at the Mercury mine, near Opalite. The Black Butte mine, in western Oregon, worked continuously on about the same scale as in 1929. Of Washington's two producing mines, the Morton Cinnabar materially increased its output, whereas the production of Consolidated Mercury Mining was smaller. However, the furnace at the



Consolidated property was completed late in the year. Production did not increase in Texas. The Chisos mine continued to be the largest producer, though the output of the Study Butte property increased, owing to the installation of a rotary furnace early in the year. Arizona production was small and scattered. Arizona Quicksilver Corporation resumed operations in December, after installing a new cast-iron condensing system and other equipment. In California, the steady producers were the New Idria, Oceanic, Oat Hill, Knoxville, Cloverdale, Sulphur Bank, and Bella Oak properties. Intermittent operations were carried on at the LaJoya, Aetna, Rinconada, Mirabel, Cuddeback, and several other mines.

No important improvements in the metallurgy of quicksilver were announced in 1930, and the standard rotary furnace, with dust precipitators and cast-iron condensing system, followed by settling tanks, continues to be in general use in the United States. Few new installations were made during 1930, though many old plants were revamped and brought up to date.

From a marketing standpoint, competition between domestic producers in the United States was keen, but the most heartening factor in this connection was the far-sighted policy adopted by the Spanish-Italian cartel in keeping out of the market, leaving it to the American producers during this period of low consumption.

Minor Metals

Paul M. Tyler

Fluctuation of Prices Within Narrow Limits Establishes No Trend

THE EFFECTS of depression are normally felt most acutely in the markets for raw materials, but, all things considered, the prices of minor metals and ores were maintained fairly well in 1930. Although the general tendency was naturally to lower levels, quotations for most of the commodities considered in this review showed no definite trend, fluctuating aimlessly within narrow limits. Spectacular declines, such as characterized the copper market, for example, were conspicuous by their absence, but this condition brings little comfort to producers, for the reason that it reveals the fact that margins between costs and prices had already been pared to a minimum before the deflation extended to other commodities and became world-wide. In the United States market trends have been somewhat altered by changes in the tariff policy, as indicated by the new duties on raw materials, notably tungsten and manganese, but in the world market antimony, manganese, and tungsten are as cheap as, or cheaper than, before the War, and even chrome, for which the demand has been unusually keen, has not exhibited any material increases in price.

Among special features of 1930 may be mentioned Russian exports, a dominant factor in the manganese industry. The uncertain Chinese developments, arising out of political disturbances, and the declining price of silver adversely affected the markets for antimony and tungsten. In the United States the new tariff bill advanced the duty on tungsten and confirmed the duties of the 1922 act on manganese, molybdenum, and antimony, leaving chromite and vanadium ores on the free list.

Antimony

BECAUSE it is used largely in storage-battery plates, bearing and babbitt metals, solder, rubber goods, and paints and fixtures, antimony is dependent for its market upon general industrial activity, and especially upon automobile manufacture. Early in 1930 news of recurrent Chinese uprising and the threat of a higher tariff in the United States affected prices, and, later, Chinese conditions again were the cause of a slight reaction from the low point reached in June. The major price trend, however, was a gradual decline from over 6c. to 5c. a pound plus duty, based on Chinese forward shipment, c.i.f., New York. American consumption, as indicated by preliminary figures for imports, was off at least 15 per cent, as compared with 1929.

In March the Senate voted in favor of increased duties on antimony, and rejected the proposal of Senator Oddie, of Nevada, to substitute a flat rate of 4c. a pound for the cumbersome sliding scale originally recommended by the Finance Committee. By the time it became a law, the Tariff Act of 1930 merely continued the existing duty of 2c. on antimony. Failure to obtain the desired increase, however, did not prevent the construction of an antimony smelter at Laredo, Tex. H. P. Henderson is president of the new company, and the Republican Mining & Metal Company, the Cookson subsidiary, is said to have a minority interest in the new concern, which is known as the Texas Mining & Smelting Company. A capacity of 5,000,000 lb. annually is contemplated, a trifle less than one-fourth the normal imports of new antimony metal that are received by the United States.

Ores will be purchased from American, as well as Mexican, sources, thus breaking the vicious circle which it is claimed has hitherto prevented the establishment of successful antimony smelting or mining enterprises in the United States. American smelters have not been assured of economical ore supplies, and American mines, on the other hand, have remained undeveloped, because of the lack of a market. Inasmuch as it has been shown that stibnite can be successfully separated by selective flotation, still another of the former deterrents to the exploitation of domestic deposits has disappeared.

Development operations on the large bodies of antimonial gold ores in the Yellow Pine district in Idaho was continued on an expanded scale during 1930, but it is doubtful if the present program will permit reaching the productive stage for at least another year, and probably not for two years or more, according to recent reports.

The low prices did not encourage production in other parts of the world. but discussion was actively revived during the year regarding the possibility of treating ores of the Antimony Reef in the Murchison Range in South Africa for antimony and gold.

C. R. Hayward's process for treating storage-battery plates, which has successfully yielded soft lead and alloys containing up to 80 per cent antimony, has been further perfected, so that even higher antimony alloys can now be made. From a practical point of view this is important, because it permits marketing the reclaimed metals for other uses when the demand for battery lead is slack.

Chromite

A REMARKABLE feature of the chrome situation in 1930 was the manner in which demand continued in the face of the slump in the markets for other commodities. Not until almost the end of the year was any abatement of production deemed necessary in Rhodesia, the principal source of world supply. The Selukwe mines began to restrict output in October, but did not close down. A small amount of interest was aroused in the possible opening up of domestic deposits, especially those in Montana, but transportation problems and the fact that the domestic ores often contain excessive amounts of either iron or silica tended to discourage investors. Foreign ores were freely available, and imports, though possibly a trifle less than the record total for 1929, substantially exceeded receipts in 1928 or any preceding year. Prices on the whole were also well maintained, particularly for the higher grades, although, as might be expected there was some shading on medium- and low-grade ores, as represented in a reduction in the New York quotation for Indian and Rhodesian ores containing under 48 per cent chromic oxide from $21.50 in January to $19.50 in December.

The Umvukwe Railway, providing improved transportation for chrome mines of the Great Dyke, in Southern Rhodesia, was completed in June. Previously, ore from these mines had to be hauled long distances in ox carts New developments in Canada are reported as indicating that the dominion may again produce chrome ore, perhaps on a fairly large scale, from two large supposedly separate deposits at Obanga Lake (Nipigon) and Shebandowan Lake, in the general vicinity of Port Arthur. At the latter locality chromite has been encountered within a depth of 125 ft., overlying a deposit of copper-nickel. about 40 miles north of the American border.

Developments in Anatolia, undertaken in 1929, resulted in a large increase in shipments of Turkish ore to various ports in the United States.

Bauxite

THE United States in recent years has become more and more dependent upon imports of bauxite. During the first few months of 1930 shipments from Dutch and British Guiana continued unabated, and, although there was some falling off later, the total for the year may be as great as that for 1929.

In Yugoslavia the revival, which began in 1929 following a brief setback, was maintained in 1930. American interests are said to have acquired a share in the Adria Bauxite Company, of Drnis, and it is said that 25 per cent of the output of this important Yugoslavian concern will henceforth be reserved for American consumption. German, French, and British capital has been interested in developing the various bauxite fields in Dalmatia and other provinces of Yugoslavia.

Clay as a source of aluminum and its salts has long attracted attention, and recent reports from Italy indicate that the production of aluminum, as well as potash, from leucite will soon be undertaken, if it has not already begun, by the Montecatini Company (which also uses alumina made by the Haglund process from Istrian bauxite). A new competitor for bauxite is now suggested in the form of kyanite, the natural silicate of aluminum. By new methods of electromagnetic treatment iron-free material can be prepared without recourse to the chemical processes employed for the purification of bauxite. A study of recent patents suggests the possibility of producing from purified kyanite an aluminum-silicon alloy which can later be refined or otherwise modified by high-temperature electrolysis, and the progress already made suggests that lower-grade kyanite concentrate might be successfully utilized by the Haglund process, yielding ferrosilicon and purified alumina.

Manganese

CONTINUANCE of the duty of 22.4c. per unit on manganese ore and its extension to cover ores containing down to 10 per cent of metallic manganese were provided by the U. S. Tariff Act of 1930. Curtailed operations at steel plants and abnormal imports of Russian ore, however, closed most of the newly equipped domestic plants. The Domestic Manganese Development Company's kilns in Butte, Mont., were idle throughout most of the year, the bulk of the tonnage shipped from Butte consisting of raw rhodochrosite which is employed in making pig iron. In Philipsburg, the production of battery ore was probably a trifle less than it was in 1929. In Georgia, output increased materially as a result of the operations of the Georgia Manganese & Iron Company, at White, but even there production fell far short of expectations. In addition to the usual trouble attending the starting of a new plant, difficulty was experienced in marketing the product and new financial arrangements had to be worked out. The new mill of the Hygrade Manganese Producing Sales Corporation, at Woodstock, Va., came into production in February, but it was operated only intermittently. An entirely new development in North Carolina, near Murphy, was brought to the productive stage. Some construction work and much development were done in many of the manganese districts. Preliminary reports, however, indicate that increases in other camps more than offset the reduction of output in Montana.

Progress in new beneficiation processes for utilizing domestic low-grade ores was continued during 1930. Probably the most significant announcement from the laboratories is that the Bureau of Mines has developed a new manganese-silicon alloy which permits the making of cleaner steel.

From the producer's standpoint the international situation went from bad to worse. For some years previous to 1914, Russia produced substantially one-half of the world's manganese, but after Russian exports ceased as a result of the World War and revolution, other countries eventually made up the deficit, and later, when Russian ore was offered once more in quantity, prices naturally tended to lower levels. The Harriman Concession was finally given up in 1928, because under American management the Russian mines failed to show a profit. Prices have dropped lower and lower, but the Soviet Ore Trust, continuing operations in this area, has progressively increased production and sales. Manganese constitutes one of the relatively few important exports from Russia, and the Soviet agents face the necessity of getting business as a means of obtaining gold credits sufficient to offset their large purchases of foreign machinery. These offerings thrust upon a restricted market caused the world price to sag below 1s. a unit, equivalent to only a little more than 50c. a unit delivered (inclusive of duty, freight, and other charges) at certain ferromanganese furnaces in the United States.

The perennial question of a manganese ore cartel was again under consideration. Soviet producers who have previously refused over and over again to adhere to any agreement tending to restrict their sales efforts are now reported to have expressed a willingness eventually to engage in negotiations with a view of co-operating with other large producers.

The long-promised, Russian electric ferromanganese plant will be at Sestafoni, in West Georgia, and will be built by Siemens-Halske engineers, at a reputed cost of 10,000,000 rubles. The initial capacity is estimated at 50,000 tons annually, to be increased later to 150,000 tons; the starting date is placed late in 1931. Electric power will be furnished from the new Rion power station at Kutais, with a capacity of 70,000 hp., to be completed in 1931, and from the Zemo-Avchal plant, near Tiflis, already operating. Both these stations are to furnish power for the Transcaucasian Railway, only the surplus energy being available for making ferro, according to the Soviet reports. Apparently, the sale of Nikopol ore will also be continued by the Soviet Ore Trust; the contract with Rawack and Grünfeld, existing since 1924, was terminated in October.

Rather meager reports have been issued with respect to South African operations. American engineers who visited the Postmasburg area a few years ago have been inclined to discount some of the statements made as to the enormous extent of the reserves of high-grade ore in this area, but the work of providing railway and port facilities capable of handling a large tonnage has proceeded rapidly enough to permit regular export business to commence early in 1931. Trial shipments of South African ore have been made to northern France and to Japan; it is said to be a tough, hard ore which stands up well in transit and works well in the furnace. The loading plant at Congella is now completed and in working order, and the main line railway from Koopmansfontein to Postmasburg was officially opened in November. Marketing will evidently be handled largely by the Manganese Corporation, which has already entered into contracts with one or more of the other South African producers to handle their ore on a royalty basis. Within a year or two exports are expected to amount to about 300,000 tons, or about 10 per cent of world requirements. Approximately half of this seems to have been already contracted for.

Molybdenum

PARTICULARLY well did the molybdenum industry weather the late business depression, but in the untimely death of B. F. Phillipson it suffered a loss that can never be quite made up. As president of the Climax Molybdenum Company, this active young pioneer was to a large degree responsible for creating the molybdenum industry.

Now so firmly established, molybdenum production will undoubtedly keep on going, but probably no other industry of comparable size has represented so largely the results of the energy and far-seeing courage of one man. At the company's mine at Climax, Colo., the new main haulage and development tunnel, known as the Phillipson tunnel, 450 ft. below the upper workings, was further advanced through heavy ground. A new 5,000-ton crushing plant, constructed at the mouth of this tunnel, should take care of the expanding needs of the flotation mill for some years. In April the Molybdenum Corporation of America, the second largest factor in the industry, acquired the ferro-alloy and chemical plant and business of the York Metal & Alloy Company.

A number of new American molybdenum mines and prospects were active in 1930. The Molybdenum Mines Company reports the development of a substantial deposit of low-grade ore at Omak, in Okanogan County, Wash. A 14-ft. vein of 1.5 per cent ore is said to have been opened up by Edgar Eather and associates near Eureka, Nev. In Colorado, the Pingrey Mines & Ore Reduction Company took steps to resume operations at its claims near the Climax Molybdenum Company property. These claims have not been worked since the War. Near Pitkin, Colo., molybdenum prospects were investigated by the Stone & Davis Corporation. In Alaska, likewise, interest was shown in molybdenum deposits near Wrangell.

In 1918, Canada produced and shipped 378,482 lb. of molybdenite, which, at War prices, was valued at $434,733, but subsequently the dominion's output has been sporadic and quite small. In 1929, however, a newly developed operation in northwestern Quebec yielded 16,150 lb. of molybdenite, and in 1930 a further impetus to Canadian production resulted from the announcement that the Superior Alloys Company would undertake the manufacture of calcium molybdate at its plant in Sault Ste. Marie. In Australia, on the other hand, molybdenum mining seems to have reached a low ebb.

Results of tests announced in 1930 by the U. S. War Department show that molybdenum can be substituted for tungsten in high-speed tools, and that such tools can be manufactured readily in quantity. To what extent such substitution will take place under peace conditions remains to be seen.

Tungsten

IN THE United States the dominant feature of the tungsten market was the increase in the tariff on ore from $7.14 to $7.93 per short ton unit of tungsten trioxide (45c. to 50c. per pound of tungsten). Anticipating this change, domestic consumers bought heavily in 1929, and deliveries continued into the first six months of 1930. Assuming that War stocks and other accumulations had been practically absorbed at the beginning of 1929, it nevertheless would appear from a study of the import statistics that approximately one year's supply, the equivalent of more than 4,000 tons of 60 per cent concentrate, was accumulated in excess of current consumption during the eighteen months preceding the passage of the new tariff act. Between June 1 and June 17, alone, a total of 1,022 tons was imported or withdrawn from bonded warehouse. Ore stocks and the ever-growing revolving fund of high-

speed steel scrap, therefore, are likely to exert a depressing influence on the market for some time, even after consumption is resumed at a normal rate.

The Chinese situation still remains unsettled. Bandit activities tended to interrupt shipments during the early part of 1930, but by June the continued absence of consuming inquiry developed somewhat lower offers from China. Movement from the interior, however, seems to have slowed up, as stocks did not accumulate at the Chinese ports, and by September the prospect of forming a new export monopoly was a sustaining factor. After cancelling a contract with the United Tungsten Mining Company, in November, 1929, the Kiangsi provincial authorities themselves undertook the business of assembling and marketing tungsten ores, but finding this arrangement unsatisfactory, the ministry in Nanking decided to grant five-year leases at the mines as a means of maintaining the quality of ore produced and also to prevent the deposits being robbed of their richest ore. The Kiangsi government meanwhile sought to dispose of the export monopoly privilege to the highest responsible bidder. Following the long period of political changes, both Chinese and other nationals have been reluctant to make any substantial advance payments until better assured as to the prospective tenure of office and legal responsibility of the contracting officials, but a permanent settlement is hopefully expected in the perplexing situation.

Bolivian scheelite continued to be imported into the United States in 1930, and several Bolivian properties, now idle, were examined by American engineers. A new discovery of scheelite reported in Rhodesia, in the Fort Victoria district, was being actively explored. In Portugal, the Beralt Tin & Wolfram Company completed a mill and commenced operations at its mines, in the province of Beira Baixa; financial arrangements were also being made by the same company to take over and equip additional placer and lode property. The grade of this material is not stated, but Portuguese ore has often been penalized in the past for impurities. In view of the depressed condition of tin mining and extensive preparations under way in 1929, Burma is likely to report a further increase in output. A little of this ore came to the United States in 1930, but normally it goes to the United Kingdom and Germany.

In the United States, despite the fact that miners were having difficulty in moving their product, fundamental faith in the future was expressed by the continuation of development work and a certain amount of new construction. A number of new companies were formed in Nevada, where the Mill City concentrator of the Nevada Massachusetts Company operated more or less continuously, but owing to the depressed state of the market the new mill at the Silver Dyke property, owned by the same company, was not started, although development work was continued at the mine. The Nightingale concentrator of the Tungsten Production Company, in Nevada, was equipped with new machinery. New strikes were reported in Boulder County, Colo., which apparently add substantially to the known reserves of workable ore in at least two of the leading mines. Considerable activity was also reported in Arizona and California, although in the latter state developments near Bishop were evidently somewhat disappointing, inasmuch as new financing arrangements were being sought. Prospecting at the Atolia mine, however, is said to have been fruitful of results. The former Germania mine, in western Stevens County, Wash., was operated by the American Tungsten Company, and James Keeth operated another property in that state, producing a small amount of very pure, high-grade wolframite.

For more than a year, English, German, and French consumers of tungsten have been associated in a centralized buying *comptoir*, or agency. It is understood that conferences with this group were held in New York last year, but no plan of action involving domestic interests could be worked out under the legal restrictions placed upon the American companies in such matters.

Uranium, Radium, and Vanadium

GROWING interest in domestic vanadium deposits was actively in evidence last year. The International Vanadium Mining Corporation, which took over the properties of the Vanadium Alloys Corporation, in Dry Valley, Utah, and near Gateway and Rifle, Colo., erected a new mill at Dry Valley, near Moab, that started producing in July. Another mill will probably be built soon by the same company to handle ore from its Colorado mines, where development work has been in progress for two years or more. The Rare Metals Corporation completed construction of its mill near Naturita, but suspended operations about the first of October. Rumors are current to the effect that the U. S. Vanadium Corporation, the Union Carbide subsidiary, will take over the property. The latter company, which according to report is contemplating the construction of a plant to treat ore from its Long Park holdings, operated continuously during 1930 its 140-ton roasting, leaching, precipitation mill at Rifle. Feed for the plant was obtained from the corporation's vanadium mine, situated twelve miles from Rifle.

The aforesaid undertakings are primarily concerned with vanadium and are based in part on roscoelite ores, but, as the proportion of carnotite ores increases, attention is being given more and more to the recovery of radium and uranium from the residues. In 1929, Representative Clyde Kelly, of Pennsylvania, introduced a bill designed to re-establish a domestic radium industry. A series of hearings held by the House Committee on Mines and Mining resulted in a request to the U. S. Bureau of Mines to report upon processes and to the U. S. Geological Survey to report upon the extent of ore reserves. These reports, submitted to the committee in December, 1930, tend to substantiate the earlier recommendations of the Bureau of Mines that any efforts to resume the production of radium from the Colorado-Utah ore areas should be carefully considered in relation to the joint production of vanadium and uranium. Current production of vanadium from carnotite indicates that the vanadium recovery covers, at least, the cost of mining, concentration, and the separation of vanadium; and the radium-bearing slime obtainable from such operations, although not particularly high grade, affords a possible source of radium at costs that do not exceed the present wholesale quotations for that high-priced element. Under these circumstances a systematic search for ores containing a higher radium-vanadium ratio such as were previously sought for radium manufacture does not appear worth while at present, especially in view of the fact that such ores are ordinarily much more erratic in their occurrence and more difficult to find.

Late in 1929, the announcement was made that prospecting in the Wilberforce district of central Ontario, about 120 miles northeast of Toronto, had revealed deposits of radium-bearing ores in quantities deemed of considerable potential importance. Preliminary tests in the Canadian government laboratories at Ottawa indicate that the ore, though rather low grade and associated with considerable thoria, may be treated satisfactorily. Available data do not indicate that this discovery will seriously challenge the Belgian monopoly, even though it may prove the basis of a moderately profitable local enterprise. So far, however, the deposit has been subjected to surface examination only. The vein is 5 to 10 ft. wide; it has been uncovered for a length of 150 ft. and traced by outcrops for another 400 ft. Results of underground development, soon to be undertaken by the Ontario Radium Corporation, will be watched with much interest.

In 1930, Canada was again the scene of a new radium find. A little below the Arctic Circle near Hunter Bay, McTavish Arm, Great Bear Lake, Shirley R. Cragg, an American engineer, located two well-developed veins, each containing two streaks of pitchblende. The radium ore occurs associated with copper and cobalt, in quartz veins, following a dike. This dike, which is 400 to 600 ft. wide, is traceable for 80 miles. A fine specimen, weighing about 2 lb., sent to me, consisted of practically pure, high-grade uraninite. For the present this region is difficult of access except by airplane, but the report of the preliminary reconnaissance indicates that the occurrence is one of the largest and richest yet disclosed.

The sudden increase of interest in radium deposits in Australia has subsided, and government authorities there are reported to have said that the deposits are so low grade that it is doubtful whether they can be worked at present. Successful exploitation depends, according to the report, on the results of investigations now being made at Adelaide.

Radium used in luminous paints was formerly considered completely lost, but in the fiscal year ended March 31, 1930, the British government laboratory recovered 200 mg. of high-grade radium salt from decayed luminous paint, reconditioned it, and retubed it for research purposes.

On Oct. 28 the Peruvian export tax on vanadium ores was increased slightly to a flat rate of 45.29 *soles*, or about $14 a metric ton of vanadium content, regardless of grade or market price. In 1929, the average grade of the exports, including concentrates from the new selective flotation plant which started operations in February of that year, was 10.46 per cent metallic vanadium content.

In Rhodesia the new vanadium plant of the Rhodesian Broken Hill Corporation is expected to contribute to an over-all improvement, represented by an increase in the extraction of zinc to 85 per cent, as compared with about 80 per cent in 1929-30. The vanadium will be produced as a fused oxide, suitable for use not only in manufacture of ferrovanadium but also for other purposes. The company is undertaking the production and marketing of ferrovanadium to the extent of about 650 tons of 34 per cent alloy annually. To assure a supply of zinc-vanadate ores, mining was commenced in the upper levels of No. 3 Kopje mine.

In Southwest Africa the output of vanadium concentrate in the first six months of 1930 is reported as 1,996 long tons, a rate substantially in excess of that for any previous year. For several years the output in this region, principally from the Abenab mine of the Southwest Africa Company, has been about 3,000 long tons annually of material that usually contains about 10 per cent metallic vanadium.

Imports of vanadium ore into the United States, chiefly from Peru, were about the same during the first ten months of 1930 as in the corresponding period of 1929. One company, the United States Vanadium Corporation, has furnished in recent years most of the domestic production of vanadium ores, and for this reason the Bureau of Mines has not been at liberty to report the output from American sources. However, the number of new operators indicates that more vanadium will be produced in the future from domestic sources, and, as imports likewise appear to be increasing, the vanadium industry in the United States, despite the loss of some export business, appears to be advancing. In addition to the aforesaid Colorado-Utah mine developments, exploration work and some production, largely of an experimental character, were reported from Arizona, where several promising bodies of lead vanadate have been opened up in the last year or two.

Tantalum

DRASTIC reduction in the price of platinum apparently did not check the use of tantalum. Demand for domestic ore, including low-grade ore, which, until quite recently, was virtually unsalable, was exceptionally good in 1930, and in Australia, likewise, the improvement noted in 1929 seems to have continued. The discovery of a new placer field, said to contain 790 tons of recoverable tantalite, was reported in North Australia.

Non-Metallics

Oliver Bowles

Sales of Construction Materials Led Decline in Depression Period

DURING 1930 the non-metallic mineral industries experienced severe depression. Those that find their chief market in the field of construction suffered more than some others, because building construction was at a low ebb throughout the year. Inasmuch as the business depression was not confined to the United States, restricted sales characterized the industries throughout the world. Passage by the United States Congress of the Tariff Act of 1930 was a noteworthy event in international trade in non-metallic minerals. The provisions of this act as they relate to each mineral will be presented in the discussion that is presented here of the individual commodities.

Excepting phosphate rock, there is a very limited exportation from the United States of the commodities covered in this review; and this mineral has maintained its export trade remarkably well. Among imports, gypsum is outstanding, for the tonnage from eastern Canada has increased greatly during the past few years. American companies that operate in foreign deposits are the principal importers. Fluorspar, kaolin, magnesite, talc, and mica are imported in considerable quantities, but the recession in manufacturing during 1930 resulted in decreased importations of these minerals, excepting mica and fluorspar.

Most of the industries are looking toward 1931 with optimism. Federal and state building and highway programs have been of much assistance to a number of non-metallic industries during the latter part of 1930, permitting them to maintain their organizations, though with reduced personnel, and, in many instances, on a part-time basis. Thus they are prepared to respond promptly to the expected resumption of building and other industrial activity in the current year.

An important effect of the depression is the interest it has aroused in cost reduction. As a rule this has not taken form in wage reduction but rather in waste elimination, in better utilization of materials, and in technologic improvements in concentration and treatment. When these industries do regain their normal stride, many of them will be able to operate on a more economical basis than was possible prior to the depression.

A long step was taken by the feldspar industry toward more definite specifications through the establishment of a standard classification. The Feldspar Grinders' Institute, in co-operation with the Division of Trade Standards of the Bureau of Standards, held two conferences of producers, distributors, users, and technical advisors. One of these conferences was convened at the Bureau of Standards in January, 1930, and the other at Toronto, Canada, in February, 1930. The classification which has been widely published was approved by a large majority of all those concerned, and it became the effective standard for new production on Sept. 1, 1930.

Barytes

THE principal barytes (barium sulphate) producing states, in the order of their importance in 1929, were Missouri, Georgia, Tennessee, and California. Missouri's production has increased greatly during recent years. Georgia production has shown exceptional fluctuations, reaching a high point in 1928 and falling off somewhat in 1929. California has been a producer of some importance since 1927, and a great increase in production took place in 1929.

Barytes enters three principal avenues of trade: (1) in ground form for filler purposes, (2) for lithopone manufacture, and (3) for the manufacture of barium chemicals. Ground barytes is used as a filler in paper, rubber, paint, linoleum, and cloth. From 50 to 70 per cent is used in paper and rubber. The market for ground barytes is divided about equally between the Mid-Western field (St. Louis to Chicago) and the Atlantic Coast states. About half of the Eastern demand is supplied from Missouri, and the remainder through imports, which are obtained chiefly from Germany.

Lithopone, which consists largely of barytes and zinc sulphide, is used extensively for white-paint and enamel pigments. The great increase in demand for lithopone, which reached a maximum in 1929, accounts in large measure for the rapid growth of the barytes industry. Lithopone plants are situated along the Atlantic seaboard, in the Middle West, and on the Pacific Coast. The barium-chemical industry has become of importance only since the War. The plants are chiefly in the East, and they use both domestic and imported raw materials. Although production is steadily growing, imports are also increasing, reaching the high figure of 85,729 short tons in 1929.

Though 1929 was a banner year for the barytes industry, a great recession in demand occurred during 1930. No production figures are available, but the great drop in imports—from over 85,000 tons in 1929 to only 26,447 tons for the first nine months of 1930—reflects the general inactivity in the consuming industries. The present tariff of $4 per ton on crude and $7.50 per ton on ground is the same as was the former duty. The uses, divided as they are among fillers, paints, and chemicals, touch a wide industrial field, and the barytes industry will no doubt respond quickly to a resumption of building and manufacturing.

Feldspar

NEARLY all of the feldspar mined is ground to a fine powder before it is used. About 87 per cent of the production is employed in the ceramic and glass industries, about 7 per cent in scouring soaps and abrasives, and the remaining 6 per cent for miscellaneous uses. A notable increase in the sales of feldspar occurred from 1921 to 1924, owing chiefly to its wider use in glass manufacture. Since the latter year the industry has shown little growth, annual production fluctuating a little above or below 200,000 long tons.

Conditions in the industry were rather difficult for producers during 1930. Grinding capacity, which is estimated at about 480,000 tons per year, is far in excess of the needs of the trade during normal times, and the demand during 1930 was so reduced that grinding plants ran at only 15 to 50 per cent capacity. There is little probability of any marked increase in the volume of feldspar ground until the pottery and glass-container industries show a decided improvement. Prices averaged $2 a ton lower than those in effect two years ago. The buyer controls the market and there is little prospect of increase in prices.

As feldspars are variable in composition and are also associated with impurities, their selection and preparation involve many complications. Much progress has been made during recent years in the classification, grinding, and blending of feldspars to adapt them to the various uses.

An important development in feldspar treatment reached the plant production stage late in 1930. The glass industry desires a feldspar that is not only free

from injurious constituents but also in granular free-flowing form, with most of the fines removed. The Tennessee Mineral Products Company, at Spruce Pine, N. C., has introduced electro-magnetic purification employing induction separator units. Remarkable success is being achieved with the process in preparing a product that is meeting with a widespread favorable reception.

Since September, 1922, a 30 per cent import duty has been in effect on ground feldspar, but crude spar has been on the free list. However, the tariff act of 1930 places a duty of $1 per long ton on crude feldspar. Nearly all of the imports come from Canada. Crude spar imports for the first nine months of 1930 amounted to 16,868 tons, whereas the total for 1929 reached 29,927 tons.

Fluorspar

THE fluorspar industry is dependent almost entirely on metallurgical processes, inasmuch as nearly 90 per cent of it is used in steel and aluminum metallurgy. The reduced demand for steel, particularly in the last half of 1930, led to a corresponding reduction in fluorspar shipments. No upturn in sales is to be expected until the steel industry resumes normal activity.

Conditions have become increasingly difficult for the fluorspar industry since the World War. The larger demands of the steel industry have drawn more heavily upon the high-grade ores, and mining costs have increased as the orebodies are followed to greater depths. As lower-grade ores are treated, the percentage of recovery is lower. Before the War a recovery of 70 per cent was attained; now it probably averages below 50 per cent. Pumping expense has also increased.

To meet increasing production costs, the industry has made noteworthy advances in milling, such as improvements in jigs and tables, which are leading to better recovery. An example of improved technology is the successful operation of a flotation mill by the Franklin Fluorspar Company, at Rosiclaire, Ill., for the production of a high-grade spar for use in aluminum metallurgy. The process is particularly effective for the removal of silica. An impure crude ore may be made to yield a product containing more than 96 per cent calcium fluoride and only 0.5 to 1.0 per cent silica. The process is applied not only to impure crude ores but also to the treatment of certain high-grade tailings that are otherwise difficult to utilize. Such tailings, having an average content of about 70 per cent calcium fluoride, 25 per cent calcium carbonate, and 5 per cent silica, have been treated by flotation, with a recovery of nearly 40 per cent and a final product averaging about 0.5 per cent silica and more than 96 per cent calcium fluoride. This process was first worked out by the U. S. Bureau of Mines.

The flotation products are, up to the present time, limited chiefly to use in aluminum metallurgy. For the ceramic trade, the concentrates are slightly off color, and, until some method of briquetting the fine product is devised, its use in most metallurgical operations will be limited.

The Tariff Act of 1930 provides as follows: "Fluorspar containing above 97 per cent calcium fluoride, $5.60 per long ton; containing not more than 97 per cent calcium fluoride, $8.40 per long ton." The raising of the line between the two grades from 93 to 97 per cent has the effect of putting a larger proportion of the imports under the higher tariff. Imports for the first nine months of 1930 amounted to 45,201 tons, compared with 54,345 for the full year 1929.

Gypsum

AS MOST of the gypsum of commerce is calcined for use in the building trades, the gypsum industry was seriously affected by the building depression of 1930. About 1,000,000 tons per year, which in 1929 was about one-sixth of production plus imports, is sold to cement plants to be used as retarder. This branch of the industry suffered less than other branches, because extensive highway construction lent substantial support to the cement industry.

The depression, which caused a pronounced recession in sales during the final quarter of 1929, continued throughout 1930. Production as reported to the Bureau of Mines for the first nine months of 1930 was much below the average nine months' production of 1929, as indicated by the following figures: Total production 1929, 5,016,132 short tons; production, first nine months of 1930 (30 companies reporting), 2,706,567 short tons. The last-named figure is subject to correction later.

Imports, which come chiefly from Canada, have increased greatly during recent years, reaching 1,036,385 short tons in 1929. An importation of 676,854 short tons during the first nine months of 1930 indicates that imports have suffered less than domestic production.

Gypsum producers foresee a rather slow recovery during 1931. Inasmuch as plastering is one of the latest steps in construction work, a revival in the gypsum industry will probably lag somewhat behind a recovery in building construction.

Some interesting work has been done in Canada by A. E. Flynn on the addition of catalyzers to anhydrite to make anhydrite plasters. L. Heber Cole, of the Department of Mines at Ottawa, has been conducting experimental work of a similar character.

The United States Gypsum Company has developed a new product sold under the trade name of "Hydrocal," which, according to claims made for it, possesses a tensile strength 2 to 3½ times that of average plaster. It is very dense and of low absorption. The United States Gypsum Company has also recently obtained control of the Albert Manufacturing Company, of Hillsborough, New Brunswick, Canada, which company has for many years produced a high-quality alabaster widely used in dental plaster manufacture.

Kaolin

KAOLIN, or china clay, is used chiefly in the manufacture of high-grade ceramic wares and paper. Much of the domestic requirement has always been imported, chiefly from England, but the china clay industry in the United States is showing steady growth. Production in 1929 was 4 per cent greater than in 1928, and imports decreased 9 per cent. This condition indicates a decreasing dependence on foreign supplies. According to figures compiled by the U. S. Bureau of Mines, imports in 1929 amounted to 279,981 short tons and domestic production totaled 518,169 short tons. In 1921 production and imports were practically equal. Only 129,214 tons was imported during the first nine months of 1930. The present tariff of $2.50 per ton is the same as it was heretofore.

During 1930 the industry was much less active, as the demands of the ceramic industries were greatly reduced. The pottery industry at Trenton, N. J., which uses both domestic and imported china clay, was operating much below normal capacity. During October and November, however, the Christmas demand stimulated activity in the generalware and art-ware plants, and they operated on increased schedules. Sanitaryware plants were showing little if any recovery toward the end of the year, but floor- and wall-tile producers noted some improvement in demand, owing to the better outlook in the construction field.

A growing interest has been noted in the use of dry centrifugal air separators for removing sand and other impurities from clay. This is a radical departure from the generally used wet processes of purification by settlement. The dry process is being used most successfully in the treatment of paper clays.

Magnesite

THE chief use of magnesite is as a refractory for lining steel furnaces, although substantial amounts are used in the production of flooring, other building materials, and certain chemicals, such as epsom salts. Consump-

tion is centered chiefly in the East, but domestic deposits are confined to California and Washington. The restriction of imports during the War gave great impetus to the Western industry. For economic reasons, however, production receded greatly from the peak year of 1920, and there was practically no growth in the industry during the six years prior to 1929. Lack of expansion during these years is to be attributed to the heavy freight charges from the West Coast, and to the duties on imported magnesite, which have stimulated the use of substitute materials, such as dolomite and chromite. Imports have declined, but the increasing use of high-grade refractories has created so great a demand that a notable recovery was noted in 1929, production increasing from 127,200 short tons in 1928 to 187,660 in 1929.

The trend noted in this review last year toward a decreasing use of caustic calcined magnesite continued during 1929, in which year the production of 11,390 tons was less than half the amount produced in 1925. The chief use is in flooring, the stucco trade having fallen off greatly. A new lightweight building material, manufactured under the trade name "Heraklith," appeared in 1930. It consists of a mixture of wood fibre and magnesite cement. If it finds wide use it may stimulate the caustic calcined trade.

The most noteworthy feature of the magnesite industry is the great increase in production of the dead-burned product, an output of 78,700 tons in 1929 representing an increase of 74 per cent as compared with 1928. Although the 1930 figures will probably be much lower, on account of the depression in steel manufacture, there is evidence of an increasing use of magnesite for furnace use. This is the result in part of the growing demand for high-duty refractories and in part to the production in California of a nearly pure magnesia refractory relatively free from iron and other fusible impurities. It is especially adapted for electric furnaces.

The U. S. Tariff Act of 1930 makes no change in the previous rates, but includes "periclase" under "dead-burned."

Phosphate

NORTH AFRICAN countries, that is, Algeria, Egypt, Morocco, and Tunis, produce about 50 per cent of the world's supply of phosphate rock, and the United States about 36 per cent. As the American industry depends to quite an extent for its prosperity on export trade, which amounts to over 30 per cent of total production, it is apparent that African production will directly influence the American industry. Though the African producers have the advantages of cheap labor, abundant supplies of raw materials, constant improvements in plant equipment and transportation, and nearness to European markets, the United States foreign trade has been maintained remarkably well. Exports in 1929, amounting to 1,142,746 long tons, were about 27 per cent greater than in 1928. For the first eleven months of 1930 exports amounted to 1,166,115 tons, thus exceeding the twelve months' exports of 1929, and indicating that phosphate-rock production has experienced better

sustained activity during 1930 than have most of the non-metallic mineral industries. Phosphate exports during the latter part of the year were very encouraging. A total of 83,242 tons shipped from Tampa, Fla., in September gives this month a leading place in the history of the port. During that month eight shiploads, totaling 28,159 tons, cleared Tampa for Japan. Germany has been the leading foreign market for American phosphate rock, but exports to Japan exceeded those that were made to Germany during the first eleven months of 1930.

Some interesting developments have taken place in the African field. Approval by the French Senate in January, 1930, for the construction of a railroad from Tebessa to the Tunisian frontier paves the way for a new rail outlet for Algerian phosphate. Therefore larger supplies may be expected from that source. The Companie des Phosphates de Constantin, operating in Algeria, is expanding its plant capacity. During the first six months of 1930 this company produced 440,000 metric tons, an increase of 10,000 tons compared with the same period of 1929. It is estimated that in two years the production will reach 1,000,000 tons a year. Tunisian production for the first six months of 1930 reached 1,513,000 tons, compared with 1,371,000 tons in the same period in 1929.

Recent developments in phosphate technology relate to the manufacture of phosphoric acid and phosphates by furnace processes and by acid decomposition methods, the treatment of superphosphates with anhydrous and aqueous ammonia, and the recovery of fluorine compounds from phosphate rock.

In the land-pebble district of Florida, much better recovery is being accomplished. Re-treatment of washer rejects in such equipment as bowl classifiers, followed by vibrating screens, has effected additional savings of fine phosphate that was formerly discarded to waste.

Flotation has been developed and is now being applied commercially to washery rejects. As a result of successful experiments conducted by the U. S. Bureau of Mines, gravity concentration has become an important feature in the flow sheets on the washers operated by one company in Florida. Extensions of this innovation in practice are to be expected.

Mica

DURING 1929 there was a substantial increase in the United States production of sheet mica, which is used chiefly in the electrical industries. The production of scrap mica was somewhat reduced. Imports of mica in 1929 were more than 50 per cent greater than in 1928. This notable increase was the result, probably, of a desire for an accumulation of stocks in anticipation of a higher tariff. This condition apparently continued in 1930, for imports for the first nine months were greater than the imports for the entire year 1928. The average unit value of imports in 1930 was, however, considerably lower than it was during the last few previous years.

With a substantial increase in both production and imports of sheet mica in 1929, and with continued heavy imports and a greatly lessened industrial demand during 1930, the industry has experienced unusual depression. When stocks are reduced and the manufacture of electrical equipment resumes normal activity, a rapid recovery of the mica industry is to be expected.

Some stimulation will no doubt ensue from the Tariff Act of 1930, which increases the duty on certain types of mica products, particularly sheet mica and splittings, cut or stamped to dimensions, and untrimmed phlogopite. The duty on thin films and splittings has been reduced. The increase in duty on sheet mica (muscovite) will no doubt affect imports from India—the chief foreign source of supply—and the increase in duty on phlogopite will likewise influence foreign trade with Canada and Madagascar.

Considerable mica is produced as a byproduct of the feldspar industry. There is some prospect of increased production of sheet mica in the Black Hills region of South Dakota.

The Zonolite Company, at Libby, Mont., is finding wider outlets for its vermiculite products. Although this type of mica occurs in many places, the Montana deposits are the only ones, up to the present time, that have found extended commercial use.

Talc and Soapstone

PRODUCTION of talc was about 8 per cent greater in 1929 than in 1928, and three new producers entered the field. Further potential production capacity was provided in 1930, though industrial conditions probably discouraged its utilization. Mac-Myrl Talc Mining Company's mill, near Marblemount, Wash., was reported to be nearly ready to operate in July, 1930; and the Craig L. Rudisill Talc Company is said to have erected a mill at Marshall, N. C. The W. H. Loomis Talc Company, of Gouverneur, N. Y., is driving an upraise at No. 1 mine, which, when completed, will be utilized as a two-compartment hoisting shaft. Milling capacity has also been increased.

A development of interest is the erection at Stourport, England, of a new factory that will be devoted in part to the manufacture of high-tension insulators made of talc or soapstone. Raw material specifications are especially exacting, it is claimed, suitable talc being found in only one locality in the world.

Silica

AS USUALLY defined, the silica industry includes quartz, ground sand and sandstone, flint, tripoli, and diatomite. The purest varieties of glassy-vein quartz are finding continued use for the manufacture of fused-quartz products. Notable improvements have been attained in silica grinding. The silica industry of southern Illinois, which for some years has employed wet grinding in chaser mills, has introduced wet grinding in tube mills, or is employing dry-grinding methods. Improved drying methods are also used. The Potters Mining & Milling Company, at East Liverpool, Ohio, has reconstructed one-half of its batch-type mill and has installed an 8x10-ft. continuous silex-lined Patterson ball mill, operated in conjunction with a 14-ft. air separator. As a result, the cost of grinding has been reduced almost one-half, and the quality of the product greatly improved.

The new silica plant of the Northwest Mineral Products Company, of Burlington, Wash., began operation about November, 1930. The raw material is obtained from two quarries at Marblemount, Wash., A particularly pure product is said to be produced, the silica content reaching 99.5 per cent.

According to reports, the Philadelphia Quartz Company, one of the longest established silica producers in America, is erecting a sodium-silicate (waterglass) plant at Baltimore, Md. Silicate of soda, best known as an egg preservative, is finding many other commercial uses. As an adhesive, it is widely used in the manufacture of corrugated boxes and three-ply, air-cell pipe covering. It is used also in laundry soaps and water softeners, as a hardener for concrete roads, and in the manufacture of acid-resisting cements.

A silica deposit, probably tripoli, of chalk-like consistency, occurring near Rogers, Ark., is being worked extensively by Corona Silica, Inc. The product is amorphous in character and is being sold under the trade name "Opalite," as a filler in hard rubber, enamel, and paints.

A more complete mechanization of diatomite mining in California is noteworthy. Open-pit quarrying is giving way to underground mining methods, the diatomite being handled in stopes by means of air-powered scrapers. The material is passed through loading chutes to a main haulage tunnel. Air drying is being replaced by a more general use of artificial methods.

Platinum

H. W. BOYNTON

IN COMMON WITH most other metals, platinum declined to new low levels in 1930. Although the market opened weak with a distinctly lower tendency, the most pessimistic student of conditions could hardly have foreseen the severity of the decline that subsequently took place. As in 1929, the highest price for the year was the opening quotation, which was $60 an ounce. From this figure the market dropped, with practically no intermediate rally, until the low of $27 an ounce was touched on Sept. 19. On Sept. 22 the price advanced, as a result of an agreement among producers, to $32 wholesale, at which figure it remained for the remainder of the year.

The decline in price was not primarily caused by a falling off in demand for platinum, but may be attributed to increased production coming on the world market, particularly from South Africa. Until a little over a year ago, the South African production was not considerable; but during the past twelve months a steady increase from this source has prevailed, and resulting competition among the various producers caused the decline to the lowest level since 1910.

The supposition might be made that in a year of depression the consumption of platinum, which is generally regarded as a luxury metal, would be considerably less than in more prosperous times. Although a smaller amount of platinum than usual was consumed in 1930 by the jewelry industry, the deficiency was partly offset by an increased consumption of the metal in the essential industries, where substitutes adopted during the period of high prices were largely discarded when platinum could again be bought cheaply. The low level of $27 referred to above is generally thought to be below the average cost of world production. Probably for this reason the various producers reached their understanding, with the object of preventing further declines, and if possible to help the price to rise to a sound economic level. Greater stability of platinum prices is desired by all interests, and in the course of time the producers will probably come to some arrangement similar to the syndication of diamonds. This would have the effect of stabilizing the price at a level that would give producers a proper return and protect consumers against the wide fluctuations that have featured the market in recent years. Since September last the market has held firm in the face of discouraging fall business in the jewelry industry, and the general opinion is that the price will soon advance further.

Although published statistics are somewhat misleading, those in a position to know believe that the South African production of platinum will, in time, be the largest in the world, with Canada second, Russia third, and South America fourth.

Iridium fluctuated in price in 1930, but finished the year at approximately the opening figure of $180. The market declined until April, at which time the price was about $140. From this level there was a sharp advance, until $250 an ounce was reached in June. The market subsequently reacted to its present quotation. At this point the price appears to be steady, although demand is small. No indication of a further decline is apparent. Should business in the jewelry trade improve, iridium will probably again sell at above $200 an ounce.

Palladium opened 1930 at about $34 an ounce, and declined uninterruptedly to $17 wholesale. The market closed firm at approximately the low for the year. An excessive supply, coupled with subnormal business conditions, makes the future of palladium uncertain; but at present low prices most of the adverse factors seem to have been discounted. An effort is being made to find new outlets for the metal.

According to the U. S. Department of Commerce, imports of platinum for the first nine months of 1930 were 72,485 oz., compared with 89,455 oz. for the same period of 1929. Iridium imports were approximately unchanged, the figure for 1930 being 3,416 oz., whereas that for 1929 was 3,308 oz. Palladium also was imported in nearly the same amount for 1930 as 1929, the figure being 16,120 oz. for 1930, compared with 16,742 oz. for 1929. Osmium and osmiridium imports for the first nine months of 1930 totaled 5,278 oz., compared with 6,301 oz. in the same period in 1929.

Uncommon Ores and Metals

H. C. MEYER

HIGH PRICES continued to retard the wider application of beryllium in 1930. The use of caesium as a catalyst in the hydrogenation of certain organic compounds was developed during the year. Cerium was in only slight demand, but a new use was developed for it as a gas purifier in the manufacture of Neon lamps. The demand for selenium and titanium continued to expand. Several important developments occurred in the commercial application of zirconium and its compounds, the pure metal being made available at $9 per pound.

Beryllium—Developments in the commercial application of beryllium metal have not been as rapid as were expected. The chief retardant is probably price. None of the metal has been sold at less than $145 per pound, and the general opinion is that no real consumption can be expected until quotations of about $10 per pound are available. Manufacturers have promised prospective consumers lower prices as soon as a consumption of 100 tons per year is assured. That any one known deposit of beryl (the only commercial ore of beryllium) could furnish large tonnages over an extended period of time is doubtful.

Rival interests in the United States and Europe have been actively engaged in the search for beryl deposits of potential size. The enormous deposits reported in Austria proved to be valueless. A good commercial beryl carries about 3 to 4 per cent of beryllium metal, so the industry at the very start is handicapped by small yield per ton of raw material and a complex metallurgy. To aggravate the situation, the price of beryl advanced sharply in 1930, owing partly to competitive demands and much unwarranted and premature publicity of a purely popular character.

In the United States most of the research work on beryllium has been directed towards its use in light alloys with aluminum and magnesium and also in so-called "electrical" copper. Foreign research and development lean toward its application as an alloy with the heavier or baser metals such as iron, nickel, and copper. Probably no light metal since the commercialization of aluminum holds such high future promise as does beryllium.

Caesium and Rubidium—Prior to the development of the vacuum tube for radio purposes, both of these elements were regarded as laboratory curios. Because of their great affinity for oxygen, they soon found application as so-called "getters" for the removal of the last traces of air in producing the high type of vacuum so essential in radio valves.

The elements appear on the market principally in the form of their salts, such as chlorides and nitrates. Only a limited production and demand prevails for them in the metallic form. As a "getter," caesium is generally used in the form of the chloride mixed with calcium or magnesium metal and compressed into pellets. Rubidium is employed chiefly in photo-electric cells, being more suitable for this purpose than caesium, because a thinner layer can be deposited on the inner side of the glass. The only important new commercial use developed for caesium during 1930 was as a catalyst in the hydrogenation of certain organic compounds.

Cerium—This element appears on the market in commercial quantities as cerium metal, ferrocerium, and cerium oxide. Both the metal and the ferro-alloy have outstanding properties which will ultimately result in large commercial demands. The ferro-alloy is strongly pyrophoric and finds application in pocket-lighters and other devices of a similar nature.

Little or no change in the price of cerium occurred during 1930, as American and foreign producers entered into a gentlemen's agreement to stabilize quotations. The market was quite limited, the alloy selling for about $6 per pound. Attempts were made to utilize ferrocerium in the form of small wafers as "getters" in radio tubes, but this use was abandoned early in the year in favor of more active and efficient substances. Cerium metal was in only slight demand, although a new use was developed for it as a gas purifier in connection with the manufacture of Neon lamps.

By far the largest use of cerium was in the form of the oxide. This oxide, which is really a mixture of cerium with other members of the cerium group, is produced in considerable quantities as a byproduct in the extraction of thorium nitrate from monazite sand. It is a source of all the cerium products, and considerable tonnages of it are consumed by the glass industry. A bright yellow glass is produced when the oxide is mixed with pure titanium dioxide in the proportion of about five parts of titanium to one part of cerium. Cerium fluoride is also used in a process to protect cloth that is used in filter presses and baghouses against acids and corrosive vapors. It is also used in the manufacture of cored carbons for ultra-violet and sunlight lamps.

Selenium and Tellurium—Although these two elements resemble each other closely in both chemical and physical properties, tellurium, strange to say, has little or no commercial use. Within the last fifteen years the demand for selenium has shown a steady growth, the 1930 production being probably more than 300,000 lb. The price for powdered selenium in 1930 ranged from $1.75 to $1.85 per pound. No commercial ores of selenium or tellurium exist, both elements being extracted principally from slime formed in the electrolytic refining of copper.

The principal consumer of selenium and its compounds is the glass industry, in which it is used as a decolorizer and also to a lesser extent in the production of ruby glass. About one-half an ounce of selenium is used to every thousand pounds of sand, a small percentage of cobalt oxide being added as a corrective. The next largest user of selenium is the rubber trade, where it is employed as a vulcanizing and accelerating agent. It is also said to be an excellent fire retardent for switchboard cables. Consumption of tellurium is limited, although it could be produced in considerable quantities should a real demand arise. It sells at a nominal price of about $2 per pound.

Thallium—This element, which closely resembles lead in appearance and chemical properties, is marketed principally in the form of the sulphate. It has a comparatively extensive application as a poison for such pests as rates, mice, gophers, and ground squirrels. Considerable quantities are purchased by California and other Western states and distributed through co-operative farm agencies.

The major part of the thallium consumed in the United States is imported. In 1930 the price of the sulphate was somewhat lower than the preceding year, ranging from $10 to $12 per pound, depending on quantity. The sulphate is also used for the preparation of a syrup used for exterminating black and red ants. Other minor uses of thallium compounds are in photo-electric cells, medicine and photography.

Titanium—The demand for and consumption of pure titanium oxide, sold under such trade names as Titanalba, Titanox, and Titanium White, continued to grow. This pure oxide has found extensive application as a pigment. Exhaustive and careful tests have shown it to be superior to white lead in many respects.

Zirconium—The year 1930 marked several important developments in the

commercial application of zirconium and its compounds. The studies of numerous investigators, extending over a period of many years, have resulted in the development of certain potential applications, but the high price of the element prevented any real industrial use. Until within the last year it had been produced on only a laboratory scale in small quantities, and prices were correspondingly high and prohibitive, from an industrial standpoint. To meet an insistent demand, a concern well known in the rare-element field embarked on the commercial production of the pure metal, which is now available in large quantities at less than $9 per pound.

World Potash Industry Prospers

J. W. TURRENTINE

SUBSTANTIAL prosperity was enjoyed by the world potash industry, as a whole, in 1930, without loss in rate of output and, in certain instances, registering gains despite the widespread industrial depression adversely affecting most other industries. Progress was continued in the furtherance of developmental plans formulated in former years of more optimistic aspects. Improvements were made in product and by-product fabrication, plants, and loading and transportation facilities. The German-French sales combine further extended its marketing facilities to still other countries.

During the year the American potash industry produced more than 100,000 tons of potash salts, equivalent to about 59,000 tons of actual potash. This output is substantially the same as that of 1929. Plant enlargements, under construction to be brought into production during 1931, were expected to increase output by about 50 per cent. New potash enterprises were reported, particularly in the Texas - New Mexico area. Of especial interest in this connection is the offering of potash salts for delivery during the early part of 1931 by one of the firms operating in this field. The results of federal research, as reported during 1930, continued to indicate with increasing assurance the commercial feasibility of additional American potash industries based on raw materials so far unexploited. Prices remained at the level fixed by the German-French combine in 1929.

Importations of potash salts into the United States during the first nine months of 1930 showed, in the aggregate, a marked increase over those of the corresponding period of 1929. During this period imports amounted to a total of 735,900 long tons, valued at $20,373,800. Entering into these totals were 714,900 tons of fertilizer salts, valued at $16,901,000, and 48,102,000 lb. of industrial salts, valued at $3,472,600. In 1929, the corresponding figures were a total of 589,100 tons, valued at $17,002,500, into which entered 558,990 tons of fertilizer salts, valued at $12,692,300, and 67,634,900 lb. industrial salts, worth $4,310,200.

Although an increase in total quantity of 147,000 tons and in value of $3,370,000 occurred in 1930, this was unquestionably the result of an increase in fertilizer salts of 156,000 tons, valued at $4,309,000, inasmuch as importations of industrial salts decreased 19,533,000 lb., with a valuation of $838,000. Exports of potash fertilizer materials from the United States during the first three quarters of 1930 amounted to 10,840 tons, valued at $450,000, as compared with 11,000 tons, valued at $473,000, in the corresponding period of 1929. This is exclusive of about 33,000 tons of prepared fertilizer mixtures exported during the same period, of which potash may have been an ingredient. In addition, potassium compounds, as industrial chemicals, were exported during this period to the extent of 1,887,000 lb., valued at $385,000, a decrease from 2,525,000 lb., valued at $453,000, in the corresponding period of 1929.

In Germany the potash industry maintained itself in 1930 on the level of performance established in 1929, with production, sales, and exports experiencing no diminution despite the adverse conditions affecting many other local industries. Potash sales for the first ten months of the year amounted to 1,221,000 metric tons of actual potash, representing a slight increase compared with those of the corresponding period in 1929—namely, 1,217,000 tons. Price concessions, effective Dec. 1, 1930, were granted internally in a peculiarly equitable manner, whereby the syndicate shares from 10 to 35 per cent of freight costs on agricultural potash, thus tending more nearly to equalize potash costs to the farmers situated in various parts of the republic and designed to promote domestic consumption. This arrangement will operate to reduce costs to consumers situated, for example, in East Prussia, at the greater distances from Sondershausen — the official distribution point—by 4 per cent on the high-grade salts to 16 per cent on the low-grade product. Further progress was made in the development of plant capacities for the production of compounded fertilizers containing potash and more highly fabricated potash salts, such as the sulphate and nitrate.

The French potash industry opened 1930 with accelerated production, producing for the first quarter at a rate over 15 per cent in excess of that for the corresponding quarter of 1929. In the second quarter, however, owing to strikes, this rate of increase was materially reduced, and it was not regained in the third quarter. Nevertheless, the output of 2,390,000 metric tons of salts, equivalent to 385,000 tons actual potash, for the first nine months of the year, exceeded by 5 per cent that for the corresponding part of 1929. During this period the output of 1,198,300 tons of treated salts represented an increase of 18 per cent over that of the first nine months of 1929. Exports to the United States in the first nine months of 1930 amounted to 289,600 short tons, valued at $5,476,600, an increase from 241,000 tons, valued at $4,155,000, in the nine-month period of 1929.

In Poland the potash industry apparently was not able to ward off the ill effects of the widespread agricultural depression, a condition which had already developed in 1929, when, despite a material increase in production to 214,000 tons of potash salts, sales decreased markedly. Nevertheless, the new mine near Kropiwnik, with an estimated production capacity of 300,000 tons, was completed. Competition with the more concentrated German salts, despite a protective tariff, and negligible exports have contributed further to depress the prosperity of the domestic industry.

The Spanish potash industry has shown a continued growth during a period of several years, advancing from a production of 28,000 metric tons of crude salts in 1925 to 244,000 tons in 1929. Exports to the United States increased from 8,000 tons in 1927 to 23,000 tons in 1929. During the first two months of 1930, 4,000 tons was exported to the United States, a rate, if maintained, considerably below that anticipated. For the year 1930 the Spanish government fixed the potash output at the minimum of 40,000 tons, 80 to 85 per cent chloride equivalent, and the maximum at 180,000 tons, and the price at 250 pesetas per ton at point of origin. Developmental enterprises, reputedly financed by American capital, are reported to have been abandoned.

The potential importance of the extensive Russian potash deposits of the Solikamsk region received additional substantiation in 1930 through German sources that summarized present developments as consisting of 30 borings and two shafts completed, penetrating carnallite strata 39 to 90 m. thick and sylvanite strata 15 to 25 m. thick.

Mining in the United States

S. D. STRAUSS
Assistant Editor

THE VALUE of the non-ferrous metals produced in the United States is greater than that of any other individual country. In a year when industry as a whole is depressed and when non-ferrous metal prices, particularly, drop to depths that they have not plumbed within the last two decades, a drastic curtailment in production is to be expected. The statistics show that these pessimistic expectations have been fulfilled. Production of blister copper from United States' mine ore was more than 30 per cent lower in 1930 than in 1929; zinc was 20 per cent lower; lead, about 15 per cent; silver, also about 15 per cent; and iron ore, about 20 per cent. The volume of manganese production increased slightly, but in a normal year it would probably have doubled as a result of the additions made to plant capacity. Gold output was higher from the gold mines, but base-metal curtailment kept the total at about the 1929 level.

To be optimistic in the face of these dolorous facts is difficult. But one can point out that curtailment was largely voluntary; that large mines as well as small co-operated in the reduction; that complete shutdowns were comparatively few; and that development and construction were fairly well maintained. Several ore discoveries of importance were made, and the belief, shared by so many commentators, that the United States as a field for the discovery of new metal deposits has been virtually exhausted is apparently not yet justified.

Curtailment of copper production was in force at the beginning of 1930, but additional cuts were made by most of the large producers at various times during the year, and at its close few large mines were operating at much above 50 per cent of capacity. Although the drop in United States production was proportionally greater than in the rest of the world, the statement cannot yet be accurately made that this country's copper industry has reached its peak. Favorable ore developments reported during the year at the Morenci, Chino, Consolidated Coppermines, New Cornelia, Anaconda, and Chelan mines more than offset the exhaustion of ore at such small properties as Arizona Commercial, East Butte, Engels Copper, Kennecott's Latouche mine, and Butte & Superior (largely a zinc producer).

Despite a year of depression, Phelps Dodge greatly strengthened its position in the copper industry by acquiring the Nichols Copper and National Electric Products companies. Nichols owns refineries at Laurel Hill, N. Y., and El Paso, Tex., as well as holding a large interest in the new Canadian Copper plant at Montreal East, Que. National Electric is a manufacturing entity with a capacity to produce 100,000 tons of fabricated copper products annually. In addition, development of the Clay orebody at its Morenci unit, Morenci, Ariz., has enabled Phelps Dodge to make plans for a low-grade, large-scale operation there. Experimental work is now under way, and the schedule calls for starting production at the rate of 25,000 tons of ore daily, or about 80,000 tons of copper annually, by 1934. Reserves are about 250,000,000 tons of ore, averaging 1.1 per cent copper. No other developments of particular significance have been reported at the company's mining properties, total production of blister in 1930 being about 60 to 65 per cent of the 1929 output.

United States Metal Production

Metal	1929	1930
Copper, tons:		
Domestic blister	1,001,500	687,500
Domestic refined	991,500	742,500
Foreign refined (*a*)	378,500	372,500
Lead, tons:		
Desilverized	381,487	324,000
Soft	235,345	200,000
Desilverized soft	55,666	45,000
Total domestic	672,498	569,000
Foreign refined (*a*)	102,135	72,000
Zinc, tons:		
Domestic	612,136	491,100
Foreign (*b*)	13,311	8,200
Manganese ore, tons (*c*)	60,379	67,000
Silver, oz.	61,327,868	48,637,798
Iron ore, tons	73,027,720	58,359,000
Gold, oz.	2,208,386	2,232,593

(*a*) Includes foreign ore, concentrate, matte, and blister imported into the United States and refined and/or smelted here. (*b*) Metal content of foreigh ore and concentrate treated in the United States. (*c*) Ore containing more than 35 per cent Mn.

Negotiations were undertaken in 1930 for a merger of the properties of Calumet & Arizona with Phelps Dodge. This consolidation would bring together two companies whose interests have always been closely connected. They own adjoining mines at Bisbee and adjacent smelters at Douglas, and co-operated in building the El Paso refinery. C. & A., although it cut output to less than 50 per cent of normal, nevertheless continued with its program of remodeling at Bisbee, Douglas, and Ajo. The New Cornelia mill now has an effective capacity of 15,000 tons daily; the Campbell hoisting unit and Junction power plants have been completed; the Junction hoisting unit is being installed; and remodeling of the smelter is continuing. Natural gas is being piped to Douglas from Texas. It will be available for use in both the P. D. and C. & A. plants some time this year.

In the Kennecott group of properties, Utah Copper, which has for many years ranked first among United States copper producers, dropped behind the Butte mines of Anaconda as the result of a curtailment program that reduced its daily tonnage from 60,000 to 25,000 tons. An earth slide, in November, although it covered several of the ore benches at the open pit in Bingham Canyon, Utah, did not interfere with operations to any great extent. Nevada Consolidated also curtailed production at its three properties. Development work south of the known orebody at the Chino unit, in New Mexico, has added not less than 50,000,000 tons to reserves, nearly all of which can be mined by open-pit methods. Kennecott suspended all work at the Latouche mine, a low-grade property on Latouche Island, Alaska, in December, and is now dismantling the equipment. Development at the Kennecott and Mother Lode properties, on the Alaskan mainland, failed to find new ore. Alaskan production was about 25 per cent below that of 1929.

Production of copper at the Montana properties of Anaconda Copper was in 1930 roughly 50 per cent of the 1929 output of about 148,000 tons. Several shafts on Butte hill were shut down completely, and the remaining units were worked as near capacity as feasible, thus reducing overhead and other charges incurred by operating a larger number of shafts. Development work was maintained at a rate proportional to production, the most important feature being the gratifying development of the Syndicate vein in the northwest section of the camp.

Inspiration Consolidated, in which Anaconda has a large interest, shut down its concentrator at Inspiration, Ariz., when the price of copper dropped. The plant had not run at capacity for several years. Addition of a 600-ton slime-treatment unit for the leaching plant was completed during the year. Walker Mining, in Plumas County, Calif., which Anaconda controls through International Smelting, operated at full capacity of 1,600 tons of ore daily until November, when a cut of about 35 per cent was made. Ore developments continue satisfactory.

United Verde was operating at 40 per cent of capacity at Jerome, Ariz., when the year ended, although over the whole of 1930 the average rate was about 50 per cent. The company continued development and experimental work with a view to maintaining employment. Most of the preparatory work incidental to equipping and concreting the new No. 7 shaft has been completed, and this unit will probably be available for hoisting on scheduled time in 1932. Metallurgical experiments were concerned chiefly with making more complete recoveries of the mineral content of United Verde ore, notably zinc. A 600-ton section, added to the concentrator, was not put into operation, because of the low metal prices. The company took an option on a large area near Miami, where geological conditions

indicate the possible existence of a low-grade copper deposit.

United Verde Extension, also in the Jerome district, again failed to find new ore deposits. A 200-ton mill was constructed to treat low-grade and siliceous material that could not be smelted direct. As the original property will probably be exhausted within two or three years, exploration for other mines was continued. A 500-ft. shaft is being sunk at the Vulture mine, near Wickenburg, Ariz., to develop the extension of gold oreshoots indicated by diamond drilling.

Miami Copper was the only large copper mine in the country to report a substantial increase in production in 1930, compared with 1929. Operations at Miami, Ariz., were maintained at the expanded capacity of 18,000 tons daily throughout the year, but the company has since curtailed. Costs were cut considerably. Old Dominion, in the same district, maintained production at the 1929 level. The adjoining Arizona Commercial property, abandoned because of exhaustion of ore reserves, was purchased to provide better ventilation and safety facilities.

Magma Copper's production in 1930 was about 75 per cent of the 1929 output of 19,118 tons. Shaft sinking was continued at the property at Superior, Ariz. Christmas Copper, near Hayden, Ariz., increased its production substantially. A new shaft, additions to the power plant, and expansion of mill capacity to about 600 tons daily were the features of operation in 1930.

Production of Consolidated Coppermines, at Kimberley, Nev., was about 32,000,000 lb. of copper in 1930. Operations were considerably curtailed, particularly in the latter part of the year. Development underground as well as through churn drilling resulted in material additions to ore reserves. Geologic studies and mapping of the extensive holdings of the corporation were continued. During the year, additional valuable mining lands along the trend of the main ore zones were acquired.

Development work by Howe Sound at the Chelan Copper property, in central Washington, has yielded very satisfactory results. Because of the uncertain metal situation, no decision on construction of a mill will be made at present, but development will continue through 1931. The property carries a low-grade vein deposit of considerable extent, developed through tunnels, and milling on a large scale will be feasible.

In the Michigan copper district, relatively the highest cost in the United States, the drop in metal prices caused suspension by the smaller companies such as Arcadian, Seneca, and Mayflower-Old Colony. The output for the whole year was about 83,000 tons, compared with 93,201 tons in 1929. Calumet & Hecla, the largest Michigan producer, constructed a new 7,500-kw. steam-power unit at its Ahmeek mill, to supplement the Lake Linden plant. Development was continued, on a somewhat smaller scale, and mine workings on the conglomerate lode were deepened to below the No. 96 level, about 5,700 ft. below the surface. At the end of the year, operations were on a four-day basis, with the low-cost reclamation units completely suspended.

Copper Range closed the Trimountain mine, prepared to close the Baltic, and curtailed at the Champion, its principal producer. Mill remodeling was completed and recoveries were considerably improved. Mohawk's output was also cut, but toward the end of the year operations were speeded up slightly. Its mine has a limited life. Exploration by the company at the Michigan mine, in Ontonagon County, was continued.

Ducktown Chemical and Tennessee Copper, operating at Copper Hill and Ducktown, Tenn., did not change their rate of copper production in 1930 despite low prices. Sulphuric acid has become the most important product from their ores. The Fontana mine, in North Carolina, which Ducktown C. & I. has been operating under lease, was sold by its owners to H. M. Thompson and associates, who formed North Carolina Exploration. A monthly production of 8,000 tons of ore was maintained throughout the year.

Lead production, largely in the hands of a few important groups, was adjusted to consumption throughout 1930. As a result, the industry did not feel the results of general depression quite so keenly as did copper and zinc. Southeast Missouri, where St. Joseph Lead and National Lead are the major producing companies, continued to be the ranking lead-mining district in the country. Output, at 196,870 tons, was virtually unchanged from that of 1929, when 197,435 tons was produced.

In the Coeur d'Alene district of Idaho, most of the small mines were forced to close down in 1930. At the end of the year, the producing companies were Bunker Hill, Federal, Hecla, Dayrock, Jack Waite, Sunshine, and Golconda. All of these companies except Bunker Hill and Sunshine were on a curtailed basis. Bunker Hill experienced a good year in spite of low prices. Development has indicated an important new lead-silver orebody of better than average grade in the Sullivan section of the mine. Additions to refinery capacity were completed, and the company now handles all of its pig lead output in that unit. Acquisition of Jack Waite by the Duthie interests of Seattle, and construction of a new 500-ton concentrator, expected to start operations this year, followed interesting ore developments at that property. Development at depth added to the ore resources of the Morning mine of Federal M. & S.

Utah, formerly a close competitor to Idaho for second place among lead-producing states, dropped considerably behind in 1930. Not only did the low price discourage production, but development at several properties yielded disappointing results. Park Utah, Utah-Apex, Utah Delaware, and New Quincy showed the largest decreases in production, proportionally. The United States mine, of U. S. Smelting, Refining & Mining, at Bingham, was virtually the only Utah property to report substantially increased output, the result of new ore discoveries and addition of the Bingham Mines holdings. At Park City, Silver King Coalition also met with favorable development results, but output was curtailed. Tintic Standard, North Lily, and Chief Consolidated at Tintic also cut the tonnages shipped to local smelters.

In view of the threatened exhaustion of some of the older producers, the three great smelting organizations in the Salt Lake Valley area have been active in development work in Utah camps. International Smelting, through its subsidiary, North Lily, is now sinking the Big Hill shaft at Tintic to explore the extensive Knight holdings at depth. American Smelting & Refining has been engaged in diamond drilling and underground exploration at Park City, American Fork Canyon, Frisco, and other areas. Western Exploration is undertaking an ambitious program of reopening old properties at Ophir.

Lead production from most of the other Western states was lower, with the exceptions of Nevada and California, which produces a negligible tonnage. In Nevada, the increase resulted from greater activity in the Pioche district. Output of lead from the Silverton district, Colorado, was lower, despite the fact that Shenandoah-Dives started a new 300-ton copper-lead-gold flotation plant early in 1930. Suspension of operations at Sunnyside, in September, was the chief cause of the decrease. In

Metal Production of Alaska

Geological Survey Estimate

	1929	1930
Gold	$7,761,000	$8,394,000
Copper	7,130,000	4,100,000
Silver	252,000	158,000

Metal Production of Arizona

U. S. Bureau of Mines Estimate

	1930	
	Amount	Value
Gold, oz.	170,000	$3,514,000
Silver, oz.	5,300,000	2,040,000
Copper, lb.	564,500,000	70,000,000
Lead, lb.	9,000,000	468,000
Zinc, lb.	1,545,000	73,000

Metal Production of Montana

U. S. Bureau of Mines Estimate

	1930	
	Amount	Value
Gold, oz.	42,040	$870,300
Silver, oz.	7,760,000	2,987,600
Copper, lb.	198,200,000	24,576,800
Lead, lb.	23,300,000	1,211,600
Zinc, lb.	70,150,000	3,297,050

Metal Production of Utah

U. S. Bureau of Mines Estimate

	1930	
	Amount	Value
Gold, oz.	199,410	$4,121,900
Silver, oz.	12,940,260	4,982,000
Copper, lb.	178,278,226	22,106,500
Lead, lb.	221,973,077	11,542,600
Zinc, lb.	85,629,788	4,024,600

Montana, the Block P mine of St. Joseph Lead, which is the state's largest producer, also closed in September; and the tonnage from the Emma mine of Butte Copper & Zinc, at Butte, was 40 per cent lower than in 1929. In Arizona, both of the largest lead producers—the Montana and 79 mines—were closed.

Zinc sold for a low price throughout 1930, with the result that striking changes were made in the source of the metal's production. The lead-free zinc deposits of the Eastern states—New York, New Jersey, Tennessee, and Virginia—are steadily increasing production, but the Mississippi Valley mines and some of the complex-ore deposits of the West are being put out of business by the depressed markets. In 1930, the Eastern states produced 169,000 tons, compared with 154,548 tons in 1929; the Central states produced only 230,280 tons, compared with 329,935 tons in 1929; and the Western states produced 201,630 tons, compared with 240,000 tons in 1929.

In the Tri-State area, many of the smaller companies were forced to suspend completely. Larger producers, such as Federal Mining & Smelting, closed their high-cost mines rather than deplete ore resources at a loss. Production as a whole was 30 per cent lower in 1930 than 1929 (214,800 tons of zinc, compared with 309,436). Negotiations for the sale of Commerce Mining & Royalty to Eagle-Picher Lead were the most important development of the year 1930. An agreement seems likely. Eagle-Picher, through Consolidated Lead & Zinc, already has important mining interests in the district, in addition to its smelting and manufacturing operations. Commerce Mining & Royalty is now the largest producer of concentrate in the field. Its new Bird Dog mill, started in June, has a capacity of 100 tons of ore per hour and may well revolutionize Tri-State milling practice by proving the feasibility of large-scale central milling. Federal M. & S. purchased the Granby claims, in the Missouri section of the district, from American Zinc, Lead & Smelting. Federal had operated the properties under lease for several years.

The New Jersey Zinc Company, the largest single factor in the United States zinc trade, by confining its smelting requirements to ore production from its own properties, continued the operation of the producing mines of both the parent and subsidiary companies throughout 1930, and also brought the Eagle mine, of Empire Zinc, at Gilman, Colo., into production. The mill on this property was completed and placed in operation during the late autumn of 1929. During 1930, the property operated continuously, perfecting practice and establishing production on a normal scale. No new construction or major development work was undertaken at any of the New Jersey Zinc mining properties during the year. Production from the Franklin mine, at Franklin, N. J., varied but little from that of 1929. At Austinville, Va., the Austinville mine was operated throughout the year at substantially the 1929 rate of production. Production from the Hanover mine, at Hanover, N. M., compared favorably with the 1929 output.

Montana showed the largest decrease in zinc output, proportionally, of all of the Western states. This resulted largely from the exhaustion of ore at the famous Butte & Superior mine, long the largest zinc producer in the state. Operations have now been completely suspended and the equipment is being dismantled. Closing of the Anaconda zinc concentrator at the beginning of November was largely the result of this shutdown, as Butte & Superior had supplied a large part of the ore handled at the plant. Anaconda's electrolytic zinc production was on a curtailed basis also, shipments from Utah mines as well as from Montana properties having been severely affected by low prices.

In Idaho, zinc is recovered largely as a byproduct of lead ores. The Star mine, which is predominantly a zinc property, was closed throughout most of the year. The Morning mine, the largest zinc producer in the state, reported a slight increase in output. Operation of the new Sullivan electrolytic plant, at Kellogg, was maintained at about one-quarter of its rated capacity (60 tons daily) after the Star closed.

Nevada and Colorado were the only two Western states to report increases in zinc output. In the former, the increase was largely the result of expansion of operations at Pioche. Combined Metals Reduction, a National Lead subsidiary, has succeeded in proving large quantities of ore in this district, which appears to be of great potential importance in both zinc and lead production. A new shaft, the Caselton, was sunk and equipped during the year; power facilities were improved; and development was carried on along the Combined Metals horizon at widely isolated points. Treadwell Yukon ran its Tybo zinc-lead unit on a curtailed basis of 160 tons daily.

Metal Production of Idaho

U. S. Bureau of Mines Estimate

	1930	
	Amount	Value
Gold, oz.	21,100	$436,100
Silver, oz.	9,260,260	3,565,200
Copper, lb.	2,754,600	319,200
Lead, lb.	266,286,540	13,846,900
Zinc, lb.	74,000,000	3,478,000

Metal Production of New Mexico

U. S. Bureau of Mines Estimate

	1930	
	Amount	Value
Gold, oz.	31,556	$652,320
Silver, oz.	1,091,000	420,035
Lead, lb.	20,867,000	1,085,084
Zinc, lb.	68,277,000	3,209,019
Copper, lb.	67,790,000	8,405,960

In Colorado, the increase was entirely the result of the first complete year of operation at the new Eagle mill, already mentioned, for Silverton and Leadville both produced smaller quantities of zinc in 1930 than in 1929. The Sunnyside closing was the chief factor in the decline at Silverton. Rico, which produced a fair quantity of zinc in 1929, was greatly handicapped by lack of adequate transportation in 1930 and produced only 488 tons of the metal. St. Louis Smelting, National Lead subsidiary, has started driving a new 6,000-ft. tunnel. A large mineralized area will be explored at depth through this working.

In New Mexico, the Pecos mine of American Metal was operated at about 75 per cent of capacity. Development at depth at this property has continued favorable, but the management does not feel justified in attempting to do more than to try to meet operating expenses at present. Peru Mining put its new Pewabic shaft, near Hanover, into operation. Ore, which is largely lead-free, is shipped to the company's Deming flotation unit for treatment.

St. Joseph Lead is becoming an increasingly important factor in zinc production. Development of the Balmat, or Sylvia Lake mine, in St. Lawrence County, N. Y., has continued to yield favorable results. A new 500-ton mill was put into operation at the property early in 1930. Concentrates from this mine, and also from the near-by Edwards mine of the same company, are now being shipped to the new Josephtown zinc plant, near Pittsburgh, Pa., which St. Joe constructed during 1930. Both zinc oxide and slab zinc will be produced by the electrothermic process at this smelter.

Universal Exploration, zinc-mining subsidiary of U. S. Steel, started an 800-ton concentrator at Jefferson City, Tenn., in March of 1930. Flotation is used at this plant for treatment of a lead-free ore similar to that mined at Mascot. Remarkably uniform concentrate, of high grade, has been produced. Mascot, operated by American Zinc Lead & Smelting, maintained zinc output at the 1929 rate. Work at the company's Jarnagin lease, near Jefferson City, was suspended when zinc prices dropped.

The decline in the price of silver closed nearly all the important silver mines in the country. At Tonopah, Nev., Tonopah Mining, Tonopah Belmont, and West End Consolidated were closed, but Tonopah Extension increased

Metal Production of California

U. S. Bureau of Mines Estimate

	1930	
	Amount	Value
Gold, oz.	437,040	$9,033,600
Silver, oz.	1,448,000	557,500
Copper, lb.	26,113,000	3,238,000
Lead, lb.	3,427,000	178,200

its production, and the total output of the district, in volume, was only slightly lower in 1930 than in 1929. Since the close of the year, Tonopah Extension also has been forced to close, and only leasers are now at work in the famous silver-gold bonanza camp. The Desert mill of Tonopah Mining, at Millers, is treating lease ore. Other silver properties to close were the Amethyst Leasing mine, at Creede, Colo.; the Presidio mine of American Metal, near Shafter, Tex.; and Anaconda's Flathead mine, near Kila, Mont. Sunshine Mining, in the Coeur d'Alene district, increased its milling capacity to 500 tons daily and became the largest silver producer in the camp. This property carries a predominantly silver ore. Even with present low prices, a margin of profit of about 9c. an ounce is being maintained. Park City Consolidated, at Park City, Utah, put its property on a regular shipping basis during the year.

Had byproduct output of gold been maintained during 1930, the United States production of the precious metal would have shown an increase of about $5,000,000. California, Alaska, South Dakota, and the Philippine Islands—the principal gold-mining centers—all reported substantial increases in output. Although predictions for continued decline in this country's annual contribution of gold have been frequent, 1930 made a slightly better record than 1929, and the prospects for 1931 are excellent.

Homestake Mining, the country's largest gold producer, operated continuously at normal capacity at Lead, S. D., throughout 1930, except for a slight curtailment in July and August, the result of the fire that destroyed the surface plant at its Ellison shaft. During the year, 1,364,456 tons of ore was sent to mill, yielding a production of $8,441,810, or $6.19 per ton, compared with $6,517,838 from ore averaging $4.53 per ton in 1929. The increase in production was caused by the approaching exhaustion of cheaply won low-grade ore from caved areas on the upper levels, and by the plentiful labor supply, which permitted increased production from the higher-grade timbered stopes. During the year, 11,309 ft. of development drifts and 8,536 ft. of development raises were driven. Diamond-drill prospecting totaled 11,789 ft. The work of repairing the damage done by the Ellison shaft fire was virtually completed by the end of the year. One or two of the compressors and the steam hoist were salvaged from the wreckage. The shaft house has not been rebuilt, the inclosures for the various units being in separate buildings so far as possible.

In Alaska, gold production increased in 1930 as a result of the operation of two additional dredges by Fairbanks Exploration, a U. S. Smelting subsidiary, which now has a total of five in the Fairbanks district. Alaska Juneau maintained its output at the 1929 rate of $3,400,000 annually. Profits were sufficiently large to enable the elimination of the remaining bonded indebtedness, and the company has declared its first dividend—the reward of many years of resourceful struggle to handle ore averaging 90c. in gold per ton at a profit.

Lode mines contributed the entire increase in California's output, as alluvial production declined. The Empire-Star properties, now controlled by Newmont Mining, at Grass Valley, were the leading lode mines in the state. Estimated bullion output for 1930 was $1,653,000, or an average of $137,800 monthly, compared with $806,000, or an average of $100,750 monthly, during the eight months that Newmont operated the properties in 1929. Development work has maintained the amount of ore in sight, despite increased production. A new 6,000-ft. tramway was built in 1930 to connect the North Star mine with the Empire mill. Experiments are being made with flotation in the North Star mill to determine its efficiency in treating oxidized lease ore from the upper levels of the property. About 4,500 to 5,000 ft. of diamond drilling was done, in addition to extensive lateral work. Virtually all the other large lode mines — Kennedy, Argonaut, Idaho-Maryland—increased output. Mountain Copper, operating in Shasta County, doubled the capacity of its cyanide plant to 600 tons daily. It treats copper-gold ores from a gossan deposit.

Probably the most important development in California's gold-mining industry was the work undertaken at Bodie by Treadwell Yukon. Virtually all the mines in this famous old camp were acquired, and extensive exploration was undertaken both underground and on the surface, with the result that a promising oreshoot of high grade was opened up in the Red Cloud area, and possibilities of developing a large, low-grade operation, similar to Alaska Juneau, were clearly indicated. A block of ground containing 50,000,000 tons will be thoroughly sampled and tested in a new 400-ton flotation plant. Already, more than 1,500,000 tons of this material has been found to assay about $1.80 per ton.

Metal Production of Nevada

U. S. Bureau of Mines Estimate

	1930	
	Amount	Value
Gold, oz.	131,540	$2,729,000
Silver, oz.	4,174,000	1,607,000
Copper, lb.	85,189,000	10,563,400
Lead, lb.	23,507,000	1,222,400
Zinc, lb.	30,000,000	1,410,000

Metal Production of Colorado

U. S. Bureau of Mines Estimate

	1930	
	Amount	Value
Gold, oz.	218,471	$4,516,196
Silver, oz.	4,290,587	1,651,876
Copper, lb.	9,787,000	1,213,588
Lead, lb.	44,646,000	2,321,592
Zinc, lb.	72,903,000	3,426,441

The high-grade ore is being treated in a 60-ton stamp mill, now in operation.

Treadwell Yukon has also undertaken development of a low-grade prospect in Nevada, where it has an option on the Birum group, near Beatty. The average grade here is expected to be about $3 a ton. Exploration through tunnels is now under way. Elkoro Mines, Nevada's principal gold mine, maintained production at the 1929 rate. The Tonopah mines, with the exception of Tonopah Extension, naturally reported smaller byproduct recoveries of gold as they curtailed silver operations. Two new Nevada gold producers were Seven Troughs Gold, which put a 100-ton cyanide plant into operation near Lovelocks, and Gold Hill Development, which started a similar mill at its property near Round Mountain.

In those Western states where base-metal mining is usually of predominant interest, some activity was in evidence in 1930 in development of properties carrying gold ore. In Arizona, Tom Reed, at Oatman, further developed its new orebody, discovered in 1929. Production was increased to about $100,000 monthly by the end of the year. The work undertaken by U.V.X. at the Vulture mine has already been mentioned. Near Clifton, increased interest in placer deposits was in evidence. In Utah, discovery of deposits carrying gold ore in the East Tintic district was made at an opportune time. The Eureka Standard property was able to supplement the curtailed production of its parent company, Tintic Standard, by greatly increased shipments of gold ore, said to average close to $20 a ton. Chief Consolidated and North Lily also did work on gold ores. In Montana, Montana Mines increased the capacity of its flotation mill at Spring Hill to 400 tons daily, although the full capacity was not utilized, and became the leading gold producer in the state. In Idaho, Yellow Pine continued extensive development work through tunnels on its properties in Valley County. United Verde Extension also undertook development at the Golden Anchor property, adjoining the Sherman Howe property.

At Cripple Creek, Colo., few changes of importance were manifest. All the ores from the district are now being shipped to the Golden Cycle mill, at Colorado Springs. Cresson Consolidated production continues to decline, but new ore discoveries in the holdings of United Gold Mines and Granite Gold have helped maintain the camp's annual production at about $2,600,000.

Canadian Output of Metals Expands

S. J. Cook

IN A YEAR marked by pronounced recessions in almost every line of production, the progress and relative strength of the mining industry in Canada during 1930 emphasized its importance in the commerce of the nation. In the face of declining metal prices, the production of copper, lead, and zinc showed outstanding advances in comparison with the figures for the preceding year, even though new records in the outputs of copper and zinc had been reached in 1929. (See accompanying table.) Nickel production was well maintained throughout 1930, in spite of the fact that a large development program was in progress. At the end of September, production for the nine months was well in advance of the corresponding total for 1929, but during the closing quarter the output was curtailed to prevent undue accumulation of stocks during the period of general industrial depression. Silver production was higher, and gold output reached a new high level, passing the 2,000,000-oz. mark for the first time.

Production of most of the non-metallic minerals dropped somewhat below the totals for the preceding year. Asbestos, of which Canada at one time produced most of the world's supply, showed a lower tonnage than in 1929. Gypsum mining, which showed greater progress during the first half of 1930 than during the corresponding period of the preceding year, felt the effects of lessened manufacturing activity later in the year, and the output for the second half was considerably curtailed. Salt production, which is of considerable importance in southwestern Ontario, where it is the basis of a growing chemical industry, was below the tonnage reported for 1929.

But, taken all in all, production of minerals in Canada during 1930 was well sustained, and, although the total value of the output for the year was less than the figure for 1929, an unusually prosperous year, the value of production in 1930 was, nevertheless, higher than in 1927 or any other previous year.

Undoubtedly, the most serious blow to the mining industry in Canada, as elsewhere, during 1930, was the marked decline in metal prices. Nevertheless, development and production continued on a large scale in most of the mining districts. In the Sudbury area, the great nickel-copper enterprise continued its large program of expansion, and, in July, 1930, opened a new copper refinery to handle the matte from the nickel-copper smelters.

In the Rouyn camp, steady and substantial advances were made. In spite of depressed metal prices, a new unit was added to the Noranda mill, and the smelter continued to treat upward of 2,000 tons daily. The new unit is reported to differ somewhat from the original 500-ton plant, and, in addition to handling about 700 tons per day, is said to achieve improved metallurgical results. Several other properties were active in this area throughout the year.

The new copper smelter at Flin Flon, in Manitoba, was put into commission in November, when a trial run was made and the first copper poured. Capacity of the plant is said to be 2,500,000 lb. of copper monthly, and 50,000,000 lb. of zinc yearly. Recently the company was treating about 2,000 tons of ore daily at the mill, and the whole plant was working smoothly. That production will probably be increased gradually until the full capacity of 3,000 tons daily is reached. Just how soon the increase to this tonnage will be effected depends on the rate at which the copper and zinc plants are able to handle the ore. Two copper roasters were put into commission in October.

Power from the Island Falls plant of the Churchill River Power Company was delivered to the Sherritt Gordon plant on Nov. 1, at which time 280 men were employed, including 90 underground. Later, development work having outstripped the progress made in the erection of the mining plant, this part of the preparation for production was discontinued. It was hoped that the new mill would be ready to be put into commission toward the end of January, 1931, but delays in the delivery of structural steel were said to have retarded progress at the close of the year.

In British Columbia, the properties at Anyox and Britannia operated throughout the year, but the declining price of copper made it difficult for some other mines to continue in operation. Copper Mountain and the Allenby mill, in British Columbia, closed down in the fall; and in the Sudbury area the Errington mine suspended production. Some properties in the Rouyn area, too, were merely kept alive, awaiting a rise in copper and zinc prices.

One of the new features of 1930 was the opening in the autumn of the Ontario Refining Company's plant at Sudbury, for the recovery of copper, silver, gold, and the platinum metals. The first customs shipments, for refining in transit reached the refinery from the Granby properties in British Columbia. It was announced that the first refined copper to be produced in eastern Canada had been contracted for by the Eugene E. Phillips Electrical Works, of Montreal and Brockville, this concern having placed an order for 5,000,000 lb. When operating at capacity, the refinery will employ about 800 men.

An interesting discovery of vanadium in the Sudbury district was reported late in the fall. Diamond drilling in the township of Drury yielded cores said to assay 6.3 per cent vanadium, 1.3 per cent nickel, gold $6.20 per ton, and platinum $1.20 per ton. Further work is being done to determine whether the find is of commercial value.

Interest in lead and zinc production centers in British Columbia and the Yukon, but there is also some production of lead in Ontario. Shipments from the Keno Hill properties of the Treadwell-Yukon Company, in the Yukon, were reported to have reached the record quantity of 10,000 tons, and another 1,000 tons was said to be in transit.

Activities at Trail were well up to expectations, and, in view of the difficulties experienced by the smaller properties because of the decline in

Official Estimate of the Mineral Production of Canada, 1930, With Comparative Figures for 1929

Dominion Bureau of Statistics

	1929		1930	
	Quantity	Value	Quantity	Value
Metals:				
Gold, fine ounces	1,928,308	$39,861,663	2,089,766	$43,199,000
Silver, fine ounces	23,143,261	12,264,308	26,171,651	10,037,000
Nickel, lb.	110,275,912	27,115,461	103,782,009	24,449,000
Copper, lb.	248,120,760	43,415,251	301,017,167	38,687,000
Lead, lb.	326,522,566	16,544,248	329,033,531	12,992,000
Zinc, lb.	197,267,087	10,626,778	259,700,849	9,393,000
Other metals	.....	4,626,347	.....	4,347,000
Totals	.....	$154,454,056	.....	$143,124,000
Non-Metallics (excepting fuels):				
Asbestos, tons	306,055	$13,172,581	244,000	$8,600,000
Feldspar, tons	37,527	340,471	26,000	266,000
Gypsum, tons	1,211,689	3,345,696	1,060,000	2,875,000
Mica, tons	4,053	118,549	1,200	110,000
Quartz, tons	265,949	561,527	200,000	400,000
Salt, tons	330,264	1,578,086	283,000	1,575,000
Talc and soapstone	.....	229,198	.....	202,000
Other non-metallics	.....	1,727,851	.....	1,354,000
Totals	.....	$21,073,959	.....	$15,382,000

prices, the continued operation of plants owned by the larger companies was of more than usual interest. This action did much to offset the depression caused by reductions in other fields. In addition to its mining and smelting activities, the Consolidated Mining & Smelting Company has undertaken a large construction program in connection with its plan for the establishment of chemical process plants to produce fertilizers and fertilizer materials; work on these plants is progressing.

In the early autumn, a new plant was put in operation at Trail for the treatment of lead furnace slag. This plant, which was the outcome of research covering a considerable period, is designed to recover the values from old lead-furnace slags that contain 15 to 20 per cent zinc, with small quantities of lead. It will be employed to treat the current production of slag from the lead furnaces and also to reclaim the values from a large accumulation of old slag.

In the Porcupine and Kirkland Lake gold areas in Ontario, the situation was generally highly satisfactory throughout the year. Dome Mines built and put into commission a new mill to replace the one destroyed by fire, and it has been stated that costs in the new plant indicate a saving of about 15c. a ton in treatment charges, as compared with costs in the former plant. McIntyre's new mill building was ready for the installation of equipment toward the end of the year, and it was expected that the whole plant (2,000 tons daily) would be ready for operation in March or April, 1931. When this plant is completed, the tonnage treated daily will be gradually increased to about one-third more than at present. Hollinger operations continued steadily throughout the year. Early in the last quarter, the physical condition of the mining industry in the Porcupine area was reported to be better than at any other time since the Hollinger fire.

In Kirkland Lake district, additions to the Lake Shore mill gave that plant a daily capacity of 2,000 tons, as against average operations in the year ended June 30, 1930, of 1,300 tons. Teck-Hughes changed over its old milling plant, so as to make it available for treating run-of-mine ore instead of tailing and low-grade, for which it has been used for the last two or three years. The erection of another milling unit, which will be completed about May, 1931, was started. This will give the plant a total capacity of 1,250 tons daily.

Wright-Hargreaves also improved its position, and resumed dividend payments in January, 1931. Sylvanite and Tough-Oakes-Burnside were active. A new gold producer was added to the list in Quebec, in August, when Granada made its first shipments.

Reduction in tonnage at the asbestos mines reflected the effects of increased competition from other world sources, notably Rhodesia. Much progress has been made in the mining of asbestos in the Eastern Townships area in Quebec, which for many years dominated the world markets, producing up to the end of 1929 about 4,510,000 tons of fiber.

Employment trends in the Canadian mining industry showed no violent fluctuations during 1930, but the gradual upward swing that marked the records for the months of May to December, 1929, steadied in January and February, 1930, and the index thereafter declined through March and April to 114.1 in May, 1930, as compared with 115.6 in May, 1929. The summer months saw little variation in the index of mining employment. In October the figure rose to 118.9, and on the first of November the index stood at 121.9, showing an average for the first eleven months of the year of 117.8, against the 1929 average of 120.1. For all the industries, the corresponding averages were 113.8 for the eleven months of 1930 and 119.0 for 1929. Therefore, though the general employment was down 5.2 points, mining lost only 2.3 points.

The magnitude of the undertakings and the extent of the development schemes now in progress in the Canadian mining industry, notably the growth of hydro-electric power installations, the metallurgical and chemical works at Trail, the smelting and refining plants at Sudbury, and the mining and smelting plants in Manitoba and in the Rouyn area in Quebec, to mention only a few, are a great tribute to the farsightedness and business acumen of those who are responsible for the promotion and direction of these great ventures.

Mining in South Africa and Rhodesia

OWEN LETCHER

IN SOUTH AFRICA, as in other countries, the world-wide slump and depression in commodity prices has had very tangible effects on the mineral industry. Base-metal prices have slumped severely. Platinum has dropped by approximately £4, and there has been a substantial fall in the price of chrome iron ore, of which Rhodesia and the Transvaal are among the leading producing countries.

In diamonds, a luxury trade, there has been a marked depreciation, and the controlling organization—the Diamond Syndicate, which had its beginnings in Kimberley and has been the principal factor regulating the sale of diamonds throughout the world for many years past—has been harassed by the Union government's desires to market large quantities of gems won from the rich state diggings in Namaqualand.

On the other hand, the gold-mining industry, which is South Africa's most important and most stable form of commercial activity, established another new record of output in 1930, the total gold production of the Transvaal being valued at £45,558,980, as compared with £44,236,141 in 1929. Furthermore, the industry actually profited in consequence of the depression. Overproduction and contraction of buying capacities in world markets have dealt harsh blows to farmers in South Africa. Maize, wool, live stock, cotton, and other products of the agriculturists have registered waning prices. As a result, more native labor has been available for the mines. A continuously adequate supply of native labor is the Rand's greatest economic need. Depression in agriculture and in other industries has caused more and more natives to seek service at the gold mines. At present the labor force totals 202,000, the largest number of colored employees that the mines have ever had in service. Then, too, the fall in commodity prices has enabled the mines to purchase at lower prices stores and supplies, including foodstuffs, of which huge quantities are issued as a free ration to native employees. The net tendency has therefore been for Rand working costs to decline in price despite the steadily increasing working depths and lengthening lateral haulages. A further advantage to the gold industry is that, under pressure of Continental buying orders, particularly from France, gold has at times been sold at a slight but appreciable premium above standard price.

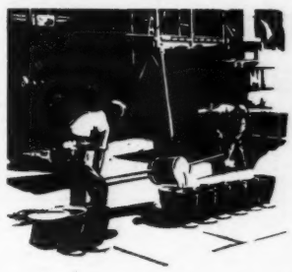
The Union government has exhibited signs of a desire to assist the major industry of the country—a not unreasonable attitude to adopt in view of the fact that but for the gold mines the commercial position in South Africa would indeed be desperate. Dr. Pirow, the government mining engineer, is understood to be sympathetic to the cause of the low-grade mines and favorable to any reasonable proposition that will enable the mine managements to bring within profitable limits as large a tonnage as possible. Yet another Low Grade Mines Commission has been constituted, and further evidence is being laid before this commission on problems relating to the mining and treatment of ores containing 5 dwt. or less of gold per ton. One would have thought that such a commission was hardly nec-

essary. Time and time again the low-grade-mines question has been investigated in all its aspects, and amongst mining men of all classes there is general agreement as to the immense quantities of low-grade ore which await reduced cost of working to yield up their gold content. Authoritative challenge is also absent to the contention that by alleviation of the burden of taxation, reducing railway rates on coal and other commodities, and by permitting the mines to recruit native labor in certain areas hitherto closed to recruiting, material reduction of working expenses can be secured.

One of the largest of the low-grade propositions on the Rand, the Randfontein Estates, has considerably improved its position and outlook during recent months. At another large "five-dwt." mine, too, the East Rand Proprietary, the outlook is much better. At East Geduld and Daggafontein developments have been favorable, and at the former property good progress is being achieved in the erection of the reduction and treatment plant. To the east of East Geduld is the huge area of the Grootvlei Proprietary Mines, and plans are maturing for the opening up of these claims, which have been proved to contain the Reef at a moderate depth. Preliminary development of the large area lying to the south of Roodepoort, known as the New Steyn Estate Gold Mines, is also being considered.

Manganese ore was mined in the Postmasburg district, Cape Province, by the Manganese Corporation, and railroad shipments were made daily to Durban. An electrically operated conveyor was erected at Congella wharf, in Durban, to load the ore into ships at the rate of 500 tons per hour for export. Important claims belonging to South African Manganese were developed on an extensive scale during 1930, and Hay Base Metals, which has acquired the holdings of Manganese Fields, has entered into a ten years' agreement for the disposal of its ore production to the Manganese Corporation.

In Rhodesia, south of the Zambesi River, the slump in asbestos and chrome prices has seriously affected the gross value of the mineral output. Demand for coal and coke by Union Minière has decreased, on account of the copper situation, and, in consequence, the anticipated expansion in sales at Rhodesia's one and only large colliery, Wankie, has not taken place. The gold-mining industry just managed to maintain its former rate of output, production for 1930 being estimated at about 550,000 oz. or a few thousand ounces less than in 1929. The Shamva property, which was for many years the most important gold mine in the country, has ceased operations, all payable ore having been exhausted. Development operations in the lower levels of the Cam & Motor mine, at Gatooma, were reported to have been less satisfactory, but this property has nevertheless managed to maintain its position at the head of the list of producing mines. More pay ore was opened up toward the close of the year in the Globe and Phoenix, and the new



Wanderer mine, at Selukwe, is now earning substantial profits. The Mayfair mine is resuming production, and at the New Giant mine, in the Gadzema district, the old shaft put down many years ago by the Goldfields interests has been reopened by a company which intends to carry out extensive exploratory operations in the belief that the former management by no means exhausted the payable ore.

No new discoveries of importance were reported in either the Matabeleland or Mashonaland provinces, but numerous prospects of encouraging character were investigated in various parts of the country, particularly in the Bubi and Penhalonga Valley districts.

According to general opinion, the discovery of one or two new gold mines of importance is a matter of great urgency to the Colony, which is passing through a most difficult economic period. Further, it is said that Southern Rhodesia is not making the most of her known and existing mines and that by the introduction of more up-to-date machinery and methods, particularly below surface, working costs might be materially reduced and much ore that is considered unprofitable might be brought within payable limits.

One pleasing feature of gold mining in Southern Rhodesia is the satisfactory progress made at the Sherwood Starr mine. The outlook at this property is most encouraging. Dividends have been increased, and the latest development disclosures are good. Apparently this property is assured of a successful career for several years.

During 1930 the Southern Rhodesian government granted a large concessionary area to important financial interests for exclusive prospecting rights. The concession was granted by consent of, and in co-operation with, the Chartered Company, owners of the mineral rights. The procedure is similar to that adopted in Northern Rhodesia, where this policy has been productive of discoveries of immense importance. Exploratory work is in progress in the Southern Rhodesian Concession: scientific and systematic methods are being applied, and a large staff of geologists is employed.

The ambitious development and construction programs previously prepared for the various copper mines in the N'Kana concession proceeded without interruption throughout 1930. The Roan Antelope property will probably commence production at the rate of 50,000 tons of metal per year in Septemper, 1931, and at the N'Kana mine, of Bwana M'Kubwa, delivery of ore to the crusher and concentrator plants is expected to start about six months later. Construction is also in progress at Mufulira, and plans are being worked out for the equipment of the N'Changa and Chambesi mines.

Large tonnages of 8 to 10 per cent ore have been discovered in the extreme western sections of the N'Changa mines and in the adjoining ground of the Rhodesian Congo Border Concession. The productivity and profit-earning capacities of these mines must, of course, ultimately depend largely on the price of copper. Mr. Chester Beatty, in his speech at the recent meeting of the Rhodesian Selection Trust held in London, professed to see in the recent marked fall in the price of the metal a blessing in disguise, in so far as the Northern Rhodesian mines were concerned, because large-scale production would not be reached for some months yet and when that stage is reached accumulated stocks of the metal will have been largely reduced and higher quotations will prevail.

The new zinc plant at Rhodesia Broken Hill operated satisfactorily throughout 1930, output being about 1,600 tons per month. A vanadium plant is being constructed at this property. N'Dola, until 1922 a frontier post, continued to grow with amazing rapidity, and it undoubtedly will continue to be the constantly expanding commercial capital of the copper fields there.

In view of the fall of the price of copper, Union Minière did not undertake any new or large expansion operations in 1930. The new Sogefor hydroelectric station at Lufira Falls was put into operation during the year. Work continues on the Musonoi or western group of mines. The prolongation of the Benguella Railway from Lobito Bay, on the Atlantic seaboard, to the point of contact with the main Congo railway system is being pushed ahead. Of both Northern Rhodesia and Katanga it may truly be said that operations during 1930 amply confirmed the view that the South-Central African copper fields contain enough metal to supply the requirements of the whole world for many years to come.

Mining in Latin America in 1930

S. D. STRAUSS
Assistant Editor

LATIN AMERICA produces more than one-half the silver and less than one-tenth of the gold output of the world. It also produces about one-quarter of the tin, one-quarter of the copper, one-sixth of the lead, and one-eighth of the zinc output. To any one familiar with the melancholy economic history of 1930—when prices of virtually all commodities, including the non-ferrous metals (with the exception, of course, of gold), fell steadily lower — these ratios indicate a sorry year for the mining industry of Latin America. And the indication is, largely, correct. But, or so the whole world hopes, one bad year does not necessarily mean a succession of poor lean years. The mineral resources of Latin America are indisputably large, and the future will undoubtedly see their exploitation intensified.

Mexico

ESTIMATES of metal production from Mexican ores, whether smelted in Mexico or abroad, are presented in the accompanying table. The sharp decline in zinc production and the smaller declines in the production of the other metals, except gold, resulted from lower prices. That silver production did not drop more sharply, in view of the virtual halving of the price of the metal during the year, may be attributed to the following factors: (1) The reluctance of the Mexican government to give permission for suspension of operations. Such permission is necessary to retain property rights. (2) Treatment of higher-grade ore, although in smaller tonnages, by many of the companies producing only silver. (3) The fact that byproduct silver, of course, continues to be recovered as long as the chief metal constituent is desired. About 30 per cent of Mexican silver production is from lead, copper, and gold ores. (4) The gain by exchange transactions. That is, the silver-mining company paid its workers in Mexican pesos, which declined concurrently with the decline in silver.

In the Pachuca district of Hidalgo, chief silver-producing center in the country, production was well maintained by Santa Gertrudis and Real del Monte. Santa Gertrudis handled much higher-grade ore than last year, but it was forced to close two of its mining units, so that the Dos Carlos mine is assuming more and more of the burden of maintaining mill tonnage at about 45,000 tons monthly. Discovery of a high-grade vein, known as Mariposa, on the 17½ level of the Dos Carlos, has resulted in the development of a small tonnage of ore averaging 85 oz. of silver and 5 dwt. in gold per ton. At the Real del Monte properties, controlled by U. S. Smelting, Refining & Mining, the work of remodeling the Loreto mill to handle the entire output of 3,500 metric tons daily was completed early in March, bringing to a close the company's program of centralization, which included driving a 5,500-m. main haulage tunnel to connect the several mines. Production for the year 1930 was substantially the same as for 1929. There was no acquisition of new properties. Development continued along the usual lines, with about the usual results. There has been no new construction since the completion of the centralization scheme.

Mexican Metal Production

Metal	1929	1930
Gold, oz.	650,859	670,000
Silver, oz.	108,701,000	103,000,000
Lead, tons	273,241	270,000
Copper, tons	95,208	80,000
Zinc, tons	191,454	137,500

These figures are for the metal content recovered from Mexican mine ores, regardless of whether they are smelted in Mexico or abroad.

In the Matehuala district, San Luis Potosi, production was maintained at the Santa Maria de la Paz property, although some labor trouble was experienced. At the adjoining Kildun group, under development by an American company, reserves of silver-gold ore, similar to that mined in the Santa Maria property, were developed, and, by the end of the year, daily shipments of 100 tons were being made to the A. S. & R. smelter. At the Noria mine, in Zacatecas, controlled by El Oro Mining & Railway, development disclosed high-grade ore at depth. Production is being maintained at 14,000 metric tons monthly and substantial profits are still being realized. The Dos Estrellas property, in the El Oro district, Michoacan, maintained production of low-grade silver ore. A wage cut of 16 per cent permitted the company to remain in operation.

Among the silver mines that were forced to close were the Cinco Minas, in Jalisco, which had been treating 500 tons of ore daily; the Favor unit of Lucky Tiger-Combination, in the same state, which had been handling about 100 tons daily; and the La Dura property of Dolores Esperanza, in Sonora. Lucky Tiger was forced to reduce the scale of its operations at the El Tigre unit, near Nacozari, Sonora, to about 60 per cent of normal, and most of the properties at Guanajuato were also compelled to cut production.

At Fresnillo, Zacatecas, the Fresnillo company ceased development work on its low-grade oxide orebody, which continued producing about 2,000 tons of silver-gold ore daily. Reserves are now sufficient for less than two years of operation, and, unless a material improvement occurs in the price of silver in the meantime, this ambitious enterprise seems destined to come to a close. The company's sulphide unit, however, is continuing expansion. Development work at depth has greatly increased ore reserves of lead-zinc-silver ore, and mill capacity has been slightly enlarged to about 700 tons daily. Three new levels are now being opened up, which will carry operations to a depth of 570 m.

The drop in the price of zinc has evidently caused an alteration, or at least a postponement, of the plans of San Francisco Mines of Mexico for construction of an electrolytic zinc plant in northern Mexico or in Texas. Production of lead concentrates in 1930 from the mine in Chihuahua was higher than it was in 1929, and the mill is being increased to a capacity of 1,400 tons daily. Shipment of zinc concentrate was suspended for two months during the year, but was resumed in September.

The total tonnage of ore produced in 1930 from the mines of American Smelting & Refining, in Mexico, was about 75 per cent of the 1929 production. Output of zinc and silver was appreciably less, lead and copper output was somewhat less, and gold production showed a slight gain, compared with 1929. The company closed its Asientos, Veta Grande, and Dolores mines because of the prevailing low metal prices, and also shut down the Monterey lead smelter. Work on the D'Inguaran copper properties, which it holds under option, was suspended. The only plant constructed during the year was the new 300-ton mill at Chihuahua City, for treatment of lead carbonate ore, and that was put into operation during the first few months. Shaft sinking at the San Pedro mines, in San Luis Potosi, was completed. The new shaft is 2,000 ft. deep.

Production was not pushed at the properties of El Potosi, Howe Sound subsidiary, at Santa Eulalia, Chihuahua, but development work was maintained at the normal rate. Shaft sinking is being continued in the Nos. 1, 3, and 5 units, with results of lateral work exceeding those obtained in diamond drilling. Mill capacity has been increased to more than 2,000 tons daily, but an average of about 1,500 tons was maintained, once the power shortage early in the year had been corrected. In addition, about 3,500 to 4,000 tons of lead carbonate ore was shipped monthly to the smelter at Chihuahua City.

Production from the properties of Cia. Minera de Peñoles, the Mexican subsidiary of American Metal, was

slightly lower than in 1929. Of the three metals that form the bulk of the company's output, zinc production showed the largest drop, with smaller reductions in lead and silver output. Shipments of sulphide ore from Avalos to the Mapimi concentrator, in Durango, were suspended, as well as shipments of zinc carbonate from the Sierra Mojada unit, in Coahuila. The Achotla leaching plant, treating silver-gold ore at Campo Morado, Guerrero, was closed in October. A drop was shown in receipts of custom ore at the company's smelters at Monterey and Mapimi, as the result of small mines closing throughout northern Mexico.

Mazapil Copper, which operates lead and copper properties in Zacatecas, suspended all operations in September, 1930, because of low metal prices, but at the end of the year, development work was resumed in one of the company's mines. At the Teziutlan unit of Mexican Corporation, in Puebla, production was maintained at the 1929 rate. The property ships copper and zinc concentrates. A small loss was incurred, but, as the company has the new Minerva orebody under development, continuance of operations was deemed advisable.

Greene Cananea, the largest copper producer in Mexico in 1929, curtailed output from its properties at Cananea, Sonora, in 1930 as surplus stocks of the metal increased. The work of remodeling metallurgical and surface plants was continued throughout the year, however, and the program of reconstruction at the concentrator and smelter was virtually completed. Some work remains to be done on the flotation sections of the three 1,000-ton mill units. Moctezuma Copper, Phelps Dodge subsidiary in Sonora, also cut production. No important new work was undertaken at this property.

Boleo Copper, the French-controlled producer in Lower California, increased its production, the total for the year having been 12,650 metric tons, compared with 11,705 metric tons in the preceding year. The company is engaged in development work to the south of its present mines, with the object of blocking out sufficient ore to justify equipment for production when the orebodies now under exploitation are exhausted.

Central America

OPERATIONS at San Juancito, Honduras, were maintained throughout 1930 by New York & Honduras Rosario Mining. Despite the low price for silver, which is the company's chief product, output was increased. Figures are not available, but both silver and gold production are known to have exceeded the 1929 totals of 2,466,095 oz. of silver and 10,246 oz. of gold, with the increase in gold output proportionally greater than in silver, as the company has been mining ore from those sections of the property that are relatively high in gold content. No important additions were made to the metallurgical or power plants. The physical condition of the mine is splendid, according to J. Perlman, secretary of the company.

Development of the properties of Panama Corporation, an English company operating in Panama, was continued through the year. High-grade gold deposits are said to have been opened in the Remance mine, and the company reports that it intends to put a 100-ton mill unit into production early in 1931. Treatment of two alluvial deposits, known as the Sabals and El Mineral, is also expected to start this year. The company has discovered some base-metal deposits on its concession, but work is not being pushed on these at present.

Argentina

PRODUCTION of refined lead at the plants of National Lead, near Buenos Aires, amounted to 4,656 metric tons in the first ten months of 1930. This is about half of the country's entire production. Development work was continued at the Aguilar lead-zinc properties, in Jujuy, by St. Joseph Lead.

Bolivia

POLITICAL unrest was caused in Bolivia by the drop in the price of tin, for the metal is the country's chief product. The low quotations obtaining for it crippled the entire economic structure of the country in 1930. All of the large Bolivian producers were forced to curtail. Patiño's production was cut from about 1,800 metric tons of fine tin monthly to 1,300 tons, and the working force had to be reduced from 5,000 to 3,000 men. Construction of new surface plant and remodeling of the Catavi concentrator were completed, giving Catavi an effective capacity of 2,200 metric tons daily. The property is still much the largest producer in Bolivia. S. I. Patiño, who is chairman of the company that bears his name, secured control of Oploca during the year. This property produced about 80,000 quintals in 1930, compared with 111,860 in 1929. The company is sinking a new shaft from its Oploca tunnel, in the Chocaya district.

Starting of the new Huanuni tin dredge was one of the brighter spots in a dismal year. This 4,000-cu.yd. unit, about 35 miles southeast of Oruro, produced about 160 tons of fine tin monthly when operated at capacity. Newmont Mining undertook development of the San Juan property, adjoining the Animas mine of Aramayo Mines, near Chocaya. Some silver-tin ore was opened up on the 230-m. level, corresponding to the 165-m. level of the Animas property. Oruro, a Chilean controlled enterprise, took over the Cia. Porvenir de Huanuni, and increased its production from an average of about 3,000 quintals monthly to about 5,000 quintals.

Among the smaller mines that were forced to close were Monserrat, which was exploiting a complex orebody near Poopo; the Milluni unit of Fabulosa; Chojnacota; Colquecheca; and Pabellon.

Corocoro United, the leading copper producer in the company, also shut down as a result of labor disputes and the low price of copper. Huanchaca, operating a new 400-ton zinc-lead-silver flotation plant at Pulacayo, reported increased production. Its ore averages 12 per cent zinc and 4 per cent lead.

Colombia

GOLD AND PLATINUM are the chief non-ferrous metal products of Colombia. South American Gold & Platinum, operating three dredges in the Condoto River valley, produced in 1930 about 27,500 oz. of crude platinum and 9,000 oz. gold, compared with 23,300 oz. and 8,054 oz. in the preceding year. No new construction was undertaken. Frontino & Bolivia, operating the Silencio gold mine, reported an increase in production as well as in the grade of ore handled. In November, production was 2,550 tons averaging better than £4 per ton. A new shaft will be put down to the north of the present main shaft. The company is reabsorbing Marmajito Mines, operating a small gold mine in Antioquia.

Brazil

DEVELOPMENT at St. John del Rey, the only large non-ferrous metal producer in Brazil, has centered on a new orebody discovered southeast of the main lode on the "22" level and in blocking out the main orebody on the "26" level. Deepening of the workings below 7,333 ft., the present maximum depth from the surface, will not be attempted until ore reserves have been fully blocked out at that depth. Production increased about 10 per cent to about 120,000 oz. for the year.

Chile

COPPER production in Chile in 1930 was about 235,000 to 240,000 short tons, compared with 348,365 tons in 1929. These figures represent the country's mine production, and should not be compared with figures for smelter production. The larger part of the decrease resulted from curtailment by the three large, American-controlled mines, and was undertaken voluntarily because of the dangerous surplus stocks burdening the industry. Several of the smaller properties were forced to close down, and others cut production to avoid wast-

ing ore resources at current low prices. Chilean gold and silver output, which is nearly all byproduct from copper operations, naturally fell also. The one producing lead mine in the country, Soc. Nacional de Plomo, was forced to close in the early part of 1930 because of the decline in the price of lead.

Braden, the Kennecott operation near Rancagua, in the central part of Chile, was on a curtailed production of about 4,500 short tons monthly at the beginning of the year. However, output was gradually increased, and in October, the last month for which figures are available, about 10,280 short tons was produced.

During 1930, operations at the mine and plant of Chile Exploration, subsidiary of Anaconda Copper, at Chuquicamata, were at a considerably reduced rate of production, owing to the state of the copper market. Data on production and the average grade of ore treated for the year are not yet available. The main construction items during the year consisted of the electrification of additional trackage at the open pit and work on the erection of a new 20,000-kw. turbo-generator at Tocopilla. This additional unit will replace one of the old original 10,000-kw. units of the company's power plant there.

Experiments were started late in 1929 to evolve a method for overcoming a slight lowering of efficiency in the electrolytic cell division. A small amount of molybdenum occurring in a part of the orebody has been the cause of this drop in efficiency. Two methods of control have been developed through the experimental work. Final tests are now being made to determine which of these two methods will best serve the purpose. Enough work has been done to demonstrate, however, that either method will increase efficiency over the former normal, resulting in a smaller power consumption.

Andes Copper, the other Anaconda producing subsidiary in Chile, also cut its output sharply, the average monthly output being under 4,000 tons, compared with about 7,000 tons in 1929. Construction work centered about the addition of a slime treatment plant and additions to the sulphuric acid unit.

Although concentrator capacity was expanded from 350 metric tons daily to 500 tons, the Disputada property, near Santiago, cut its production when the price of copper fell. The total for 1930 will be about 19,000 short tons of concentrate, averaging 21 per cent copper, compared with 25,800 tons in 1929. Tocopilla Mining, north of Antofagasta, reduced its shipments of direct-smelting ore, but increased its concentrate output from the enlarged 250-ton flotation plant. Totals for 1930 will be about 19,000 tons of smelting ore, averaging 15 per cent copper, and 9,000 tons of concentrate, averaging 28 per cent. Cie. Minière du M'Zaita, the French company which is operating the old Chagres properties, increased output about 25 per cent to more than 4,000 short tons of blister. A new mill was built at the company's Soldada mine. Poderosa, the English company operating properties at Collahuasi, Tarapaca, cut its production by more than a third. Gatico, which had been operating its smelter near Tocopilla on ore from its own mine, closed down in September.

The drop in the price of copper was a serious blow to the Caja de Credito Minero, or Chilean mining bank, which had been advancing funds to small properties throughout the country. However, construction of its three 100-ton custom flotation plants was completed, and they were put into operation in the closing months of the year.

Venezuela

IN THE BOLIVAR district, New Goldfields of Venezuela put the first 350-ton unit of a new cyanide plant into operation during 1930. Mine developments are reported encouraging, and the average grade of ore handled in the mill has been about 19 dwt. in gold per ton. The company has acquired the extensive holdings of Bolivar Venezuela Gold Mines, which lie east of the New Goldfields concession.

A new 200-ton flotation plant was put into operation at the property of South American Copper, near Aroa. Difficulty was reported in making a satisfactory extraction, and the low price of copper hampered expansion of the operations. However, development west of the area from which ore is now being extracted has disclosed high-grade deposits, averaging 6 to 7 per cent copper.

Cuba

PRODUCTION of Minas de Matahambre at its property, Pinar del Rio, was 34,108,800 lb. of copper from 369,130 tons of ore. Development included 17,797 ft. of lateral work, 9,760 ft. of raising, and 1,485 ft. of shaft sinking. The new No. 2 four-compartment shaft reached a depth of 2,057 ft. Shaft pockets and connection with No. 1 shaft will be completed early in 1931. Hoist capacity is 150 tons hourly from 3,500 ft. An operating force of 1,100 men has been maintained. American Metal, which controls Matahambre, took an option on the Reina Victoria property, in the Hoguin district, Province of Oriente, but suspended work, as development failed to disclose deposits of interest.

Peru

LIKE Chile, Peru was greatly affected by the drop in the price of copper. Cerro de Pasco Copper Corporation cut production, restricted capital expenditures, and increased its efforts to discover new operating economies through research and experiment. The riots which followed the revolution in the latter months of 1930 necessitated closing all operations for about a month. No damage was done to mines and plants. However, the shutdown did accentuate the curtailment in the company's output. At present, pending improvement in the metal markets, copper and silver production is about two-thirds of normal. Lead and zinc output is still completely suspended.

During 1930, recovery of byproduct bismuth was put on a commercial footing. Cerro de Pasco is now one of the principal bismuth producers of the world. Research under way at present includes study of the possibility of milling all copper ores and also of recovering the copper content of Casapalca lead-zinc ores.

New construction has been largely suspended. The Mahr drainage tunnel, now 6,000 ft. in from the portal, is being continued, however, as are the additions to the smoke-abatement plant and some of the work at the Mantaro hydroelectric project. Treatment of *pacos* oxidized silver-lead ores; the proposed electrolytic zinc refinery; the railroad to the Jatunhausi coal fields and the Yauricocha copper mines; and completion of the new Casapalca concentrator have been temporarily suspended. However, the experimental leaching plant built for treating *pacos* ore is being continued in operation on the richer sections of this low-grade orebody.

During 1930, Northern Peru Mining & Smelting, subsidiary of American Smelting & Refining, continued development and operation of its Peruvian properties. The Samne mill, which treated gold-silver ores from the Milluquachi district, was closed down during the year. Ores from these properties are now being shipped to the Shorey smelter for use as siliceous flux in the smelting of heavy sulphide copper ores from the Quiruvilca mine.

At the Santo Domingo mine, near Tirapata, Inca Mining & Development added a new 540-hp. hydro-electric plant to its equipment so as to permit an increase in milling operations from 70 to 150 tons of gold ore daily.

Europe, Siberia, Far East, and India

DONALD J. FARQUHARSON

METALLIFEROUS mining in the United Kingdom suffered a severe blow during 1930 from the heavy fall in the price of tin. Unsuccessful attempts to raise fresh capital resulted in the closing down of Dolcoath, followed by suspension of operations at other well-known Cornish mines, such as Wheal Kitty, Levant, South Crofty, Geevor, and Jantar. In fact, were it not that East Pool & Agar is operating a single shift, it could be said that tin production in Cornwall has completely ceased. This state of affairs has resulted entirely by reason of the collapse of the tin market and was not caused by any inherent decadence of the mines themselves, recent developments at a large number of which have been more encouraging than for years past, although costs have tended downward. Adequate preparations have been made to resume operations immediately the metal price recovers.

Little else of importance has occurred in the limited field of British metalliferous mining. The Mill Close lead mine, in Derbyshire, is again operating at a profit, despite the low metal price, and an active development program is giving encouraging results. The only other event worth mention is the government inquiry into the possibility of reviving the ancient gold-mining industry of North Wales. Evidence was given that mining of free gold had been carried out in the past over considerable areas, the metal occurring in highly impregnated pockets, but that incompetency of management and the desire for quick profit had led to uneconomic practices. As was generally expected, the government has issued an adverse report, Prof. Henry Louis stating therein that the payable gold in this belt is too sporadic to make mining anything but a highly venturesome speculation.

In Spain, the Rio Tinto and Tharsis companies are suffering from low copper prices and the discount on pyritic over native sulphur. Rio Tinto has cut its interim dividend from 25 to 10 per cent; gross trading profits for the first half year declined 34 per cent, and the directors expect that profits for the second half will show an even greater shrinkage. The company continues ever on the lookout for fresh copper deposits, and, in addition to its new interests in the Northern Rhodesian fields, is examining properties in the eastern Mediterranean and elsewhere. Tharsis reports a slacking off in demand for its products, but is developing its properties actively, including a scheme for working the Sierra Bullones lode at a lower horizon, independent of the open-cast workings, thereby increasing the production of the mine. Tigon Mining & Finance is believed to have suffered disappointment in its sulphur concession near Almeria, for it reports having acquired control of large sulphur mines in Chile. The Almeria plant, after many delays, eventually underwent preliminary trials in June, but is not yet producing; its initial capacity is to be 5,000 to 6,000 tons of brimstone per year. Tigon's antimonial silver-lead deposit has proved worthless, but the company is retaining the concession for its iron-ore contents. It has done no work on its tin or gold areas. The Peñarroya Company recently doubled its capital to 312,500,000 French francs, to assure continuation of its program of expansion by share participations. It buys more lead-zinc ore than it produces, and, as these purchases are on a metal price basis, the company's prosperity is little affected by the slump in prices. Extensive potash beds are reported to have been discovered over an area 250 miles by 80 miles in northern Spain, which the state intends to exploit. They are said to be about 30 ft. thick, and to lie at an average depth of about 300 ft. from the surface.

The Beralt Tin & Wolfram Company's new mill and ropeway, in Portugal, came into commission during the year. The company recently issued debentures in London to cover the cost of a new area acquired, which it is intended to equip to yield 10,000 cu.yd. of alluvial per month. Despite the low price of tin, the Portuguese Spanish Tin Mining Company has been formed in England and has been granted a government concession covering several tin mines in Portugal. The Villemagne company, of France, controlled by the Mining Trust, has continued operations on a normal basis and is treating about 15,000 tons of lead-zinc ore per month. Developments on the lowest levels are encouraging, and ore reserves are estimated at 4,000,000 tons. The French Laurion Mining Company, owning lead and other mines in Greece, has been drastically reconstructed.

American geologists, including representatives of the American Smelting & Refining Company, are reported to have been investigating the mineral resources of Bulgaria and to have secured a two-year option over certain areas. The plant of Trepca Mines, the Chester Beatty interest in Yugoslavia, is now treating over 500 tons lead-zinc ore per day from its Stantrg mine. Transport is easy by rail to Salonica port via Belgrade. The mine is being developed by adits, thus obviating heavy capital charges. Working costs average 25s. per ton. Ore reserves are 1,750,000 tons, assaying 11.5 per cent lead, 10.5 per cent zinc, and 3 oz. silver per ton. The metallurgical recovery is 95 per cent lead and 85 per cent zinc. Boliden Mines, of northern Sweden, discovered in 1924 by electrical prospecting, will soon be equipped, permitting the refining of 300,000 tons of ore per year for an estimated recovery of 7,000 tons of copper, 6,000 kg. of gold, and 23,000 kg. of silver, besides the recovery of arsenic, sulphur, and other products. According to estimates, 10,000 tons arsenic per year could easily be produced, were this large amount salable. An arsenic concrete, stated to be insoluble in water, is being developed.

Capitalist enterprise in Russia received a severe shock by the final break between Lena Goldfields and the Soviet government. All operations were suspended in April, and in May the concessions were taken over by the Russian Gold Trust. Each party summoned the other to arbitration, and the court, sitting in Berlin, canceled the concession agreement and awarded Lena Goldfields £12,965,000, payable by the Soviet government in sterling and carrying interest at 12 per cent per year. Up to the present, neither recognition nor payment has yet been made by the Soviet. On the other hand, the Tetiuhe company continues to operate its argentiferous lead-zinc concession, and reports "friendly relations" with Moscow. Promising disclosures on the present bottom levels of the mine indicate that the ore reserves, at present 911,000 tons, should be increased by further development. The mill capacity is now 400 tons daily, and operation of a lead smelter is about to start.

In Korea, Chosen Corporation continues to mill 9,000 to 10,000 tons monthly of gold-silver ore from the Great Nurupi mine. The ore is valued at 25 to 30s. per ton. Operating costs are about 17s. 6d. per ton, so working profits average £5,000 per month. No dividend has been paid. The company has secured continuity of title to selected mining areas by the vesting of permanent mining claims in three operating Japanese subsidiaries.

The story of tin mining in the Far East is one of increasing measures of output restriction and their failure, so far, to compensate for greatly reduced consumption, with consequently increased stocks and lower prices.

The mines of Kolar Goldfield, in India, have experienced a disappointing year, largely the effect of strikes last April. Ooregum, which also suffered from heavy rock-bursts affecting important stopes and thereby lowering the grade of ore mined, has passed both preferred and ordinary interim divi-

dends. Production remains on a reduced scale. Mysore reduced its interim dividend, but Nundydroog again pays 7½ per cent, reporting that developments in hitherto disappointing sections now show substantial improvement. Ore reserves at Champion Reef are higher at 278,080 tons. An encouraging new shoot has been developed on the 70 level, but, owing to the pressure at 7,000 ft. depth, this and similar reefs cannot be mined clean and must be regarded only as "sweeteners," enabling a large proportion of much lower-grade ore to be mined and treated profitably. Exploration at Balaghât is being pushed ahead on the 48 level on a new "make" which gives the impression of being the fringe of a new orebody. Ore reserves are lower, and the tonnage crushed and gold returns must continue to diminish unless new ore is soon discovered.

Indian Copper Corporation's new rolling mill started up in July, 1930, and supplies a local market greatly in excess of present capacity. Refined copper production for 1930 has been at the rate of 2,500 tons per year. Ore reserves are about 800,000 tons, averaging 3.32 per cent, the grade of ore showing a steady improvement at depth. Sales of kyanite (sillimanite) from the corporation's Kharsawan area have increased. Low metal prices robbed Burma Corporation of a record year ended June 30, and operating profits shrank by £429,000 to £1,059,560. Mining 500,600 tons of lower-grade ore than reserves (except for copper), there resulted a record output of 79,267 tons of refined lead, besides 7,250,000 oz. of silver, 56,000 tons of zinc concentrates, and 12,900 tons of copper matte. Last year's intention to mill 40,000 to 45,000 tons monthly of somewhat lower-grade ore than milled hitherto was abandoned, owing to the accumulation of moderate unsold lead stocks. The new section of the mill was adapted instead to treat copper ore, thereby increasing matte production. Metallurgical efficiency contines to improve and operating costs to fall. The outstanding feature of the development work of the year was the discovery of the southern extension of the Chinaman orebody on levels 2 and 6.

The Mining Industry of the U.S.S.R.

V. KARMASHOV

WHEN the plan for the development of the non-ferrous metal industry of the Union of Socialist Soviet Republics was published last year, many, both at home and abroad, doubted the results and criticized those who claimed that the program could be realized. Production figures for the years 1928, 1929, and 1930, however, compared with those of the pre-war year 1913, given in Table I, illustrate the rapidity with which the industry is being developed and to what extent the program is being accomplished.

This table clearly illustrates the upward trend in production, particularly the increase in the amount of copper smelted in 1929-30, compared with the record for the year 1928-29. The estimated program for 1931 forecasts a further increase of copper to 65,000 tons and of lead to 14,000 tons. In our opinion, the output for 1931 will go above the estimate, in view of the fact that two new zinc smelters were put into operation a short time ago—the Konstantinovka plant, in the Ukraine, and the Belovsky plant, in Kuzbas (Kuznezk Basin), with a combined yearly capacity of 27,000 tons of zinc and 50,000 tons of sulphuric acid. The new copper smelter in the Urals, the Bogomol Copper Combine, is also nearing completion and will start operations in May. It has an estimated annual capacity of 25,000 tons of copper.

In addition to these new plants several old copper mines and smelters are being enlarged and modernized. The extent to which this work is progressing is illustrated by the capital investment shown in Table II.

The third year of the Five-Year Plan will be the decisive one. For the first two years the results show that the plan will be accomplished in four years, and, as far as the non-ferrous metal industry is concerned, its fate will undoubtedly be decided in the coming year. At the present time detailed plans and drawings are being prepared for the following plants: (1) the Kazakstan Copper Combine, with an annual output of 50,000 tons, consisting of a central smelting plant and several ore-dressing plants, such as that at Kounrad, treating a daily tonnage of 10,000 tons of ore, and that at Djeskasgan, with an annual output of 25,000 tons of copper concentrate; (2) the Nerchinsk-Kemerova lead-zinc plant, with an annual capacity of 30,000 tons of zinc and 20,000 tons of lead; (3) the Chimkent-Turlan lead plant, with an annual capacity of 50,000 tons; (4) the Cheliabinsk electrolytic zinc plant, with an annual capacity of 20,000 tons; (5) the Vladikavkas lead-zinc plant, with an annual capacity of 20,000 tons of zinc and 10,000 tons of lead; (6) Alaverda copper smelter in Transcaucasia, with an annual capacity of 15,000 tons of blister copper; (7) Moscow lead refining plant, with an annual capacity of 30,000 tons; (8) several small copper smelters will be started at Kalata, Karabash, and Pishma in the Urals; (9) new reverberatories will be installed at Karabash and Kalata. The Ridder electrolytic zinc plant will be working full capacity.

This development indicates that the Soviet Union will in 1931 become the largest copper producer in Europe. *Berliner Tageblatt*, commenting upon my recent article in this publication, entitled "The Non-Ferrous Metal Industry of Soviet Russia," remarked, "Russia—importer of metals! Fantastic plans! If the lead consumption at the present time is assumed to be 40,000 to 55,000 tons, the Russian plants should be able to produce 143,000 tons in 1932. The question then arises, if the Russian industries will be able to absorb such a quantity."

The answer lies in the rapid development of railroad and city transportation and the growth of the electric and machine industries, which has increased the demand for non-ferrous metals to a point where estimated production falls far below actual requirements of the industries of the country.

According to estimates, the non-fer-

Table I—Yearly Production of Non-Ferrous Metals

	Metric Tons				
	1913	1928-29	1930	1931	1933
Copper	29,000	30,000	50,500	65,000	195,000
Lead	1,000	4,000	4,500	14,000	116,000
Zinc	.....	5,000	8,000	20,000	148,000

Table II—Capital Investment in Plant Improvements

	1928-29	1929-30	1931
Capital investments	$18,500,000	$45,000,000	$175,000,000
Increase over previous year, per cent	40	140	290
Percentage of Five-Year Plan	77.6	85	100

rous metals required annually for the completion of the Five-Year Plan in 1933 will be as follows: Copper, 413,000 tons; zinc, 154,000 tons; lead, 221,000 tons; aluminum, 64,000 tons. This demand cannot be regarded as surprising when the scale of the undertaking is submitted to a careful analysis. The estimated output, compared with the actual demand, shows clearly that importation of non-ferrous metals will increase from year to year.

Mining in Australasia in 1930

PETER G. TAIT

THE downward trend of base-metal prices in 1930 seriously affected the principal producers in Australasia, and it was disastrous for the smaller mines. A lower monetary return for the industry resulted, a number of producers being forced to close down.

Speaking generally, only in Western Australia is any systematic attempt being made to extend the gold-mining industry, and even there the movement is practically limited to the Lake View and Star, at Kalgoorlie, and the Wiluna mines, where a treatment plant to handle 40,000 tons of ore per month is approaching completion.

During the year many new finds have been reported throughout Australia, but in no instance has a mine of real promise been discovered. The economic depression is compelling many men to go prospecting or to seek a living on old alluvial fields. Mining engineers and geologists, however, know where gold is to be found in large quantities, but present high costs militate against successful exploitation. The extremely high customs tariff on machinery and engineering supplies hits the mining industry particularly hard.

The New Guinea fields are still in the development stage, and it is difficult to express any definite opinion as to the future. New Guinea Goldfields is opening up its lode deposits, and Bulolo Gold Dredging is installing two 10-cu.ft. bucket dredges, which will be transported to the field in sections by airplanes. No accurate figures of the output for the past year are available.

The purchase by Austral Development of the Mount Coolon gold mine, in Queensland, a property owned by a small syndicate and equipped with a plant lacking somewhat in efficiency, is noteworthy. The Gold Mines of Australia has been formed to work the mine.

Termination of the contract with the British Board of Trade for the purchase of zinc concentrates at the end of June, together with the low price of the metal, has seriously affected Broken Hill producers. Only North Broken Hill, Broken Hill South, Zinc Corporation, and Sulphide Corporation (Central) mines are working. Treatment of the lead residue for production of zinc is unprofitable, and at least one of the mines is using tailing for stope filling. The aforesaid companies have indicated an intention to terminate the present agreement with the labor unions, and whether they will reopen after the holidays, even if the unions should agree in the meantime to work longer hours at lower rates, appears uncertain. The trend of the metal market will be the deciding factor. Electrolytic Zinc announced at the end of October that approximately £400,000 was the value of the unsold stock of metal on hand, and it is a fair assumption that this item will be increased by the end of 1930. Considerable stocks of lead and silver are understood to be held by Broken Hill Associated Smelters.

The Electrolytic Zinc Company, which has developed the Hercules-Mount Read group of mines on the west coast of Tasmania, expected to complete the erection of its large concentrating mill at Rosebery at the end of the year, but has decided to postpone active mining and milling work. This is a great disappointment to all concerned. The extent of these deposits has been known for many years, but circumstances have prevented their successful development on numerous occasions just when the outlook was promising.

What can one say about Mount Isa and its prospects? This much at least: Those responsible for its development have transformed an unsettled area into a thriving community with all the amenities of civilization. They have developed the mines by modern methods and are equipping them to treat 1,500 tons per day. The mining and treatment plant being erected is approaching the production stage. Situated as the camp is, 600 miles from the coast, it seems too much to expect that costs can be kept down to make the proposition payable at present prices. On the basis of lead at £15 and silver at 1s. 7d., Mining Trust, consulting engineers for Mount Isa Mines, estimated that operations would yield a profit of £461,000 per year.

The Captains Flat mine of the Lake George Corporation is doing little at present. The company's first essential is a railway 27 miles in length, but no definite action has been taken in this direction or in regard to the erection of a treatment plant.

For the year ended Sept. 30, 1930, production of Mount Lyell Mining & Railway, at Queenstown, Tasmania, totaled 9,817 long tons, against 7,808 for the preceding year. Capacity of the plant has been increased to 13,000 tons of copper per year. Costs have been considerably reduced by utilizing the tunnel connecting the mine and works, which replaces the former expensive haulage arrangement and reduces pumping costs. The bulk of the copper output is sold to Metal Manufactures, but production is in excess of local consumption.

Tributers operating on the Cloncurry field, in Queensland, have produced in the aggregate a fair tonnage of high-grade ore (12 per cent or higher), which is sent to the Chillagoe government smelting works or the plant of Electrolytic Refining & Smelting, at Port Kembla.

The tin mines, lode and alluvial, have been seriously affected by economic conditions. Mount Bischoff, which has been operating its mines and smelter in Tasmania continuously since 1878, has definitely closed. The Briseis tin mine, at Derby, which was the scene of a flood disaster early in 1929, has been unable to restart. Present prices make operations unprofitable for a large majority of the Australian sluicing companies.

Japan

HIRONAO NISHIHARA

METAL production in Japan during the twelve-month period from August, 1929, to July, 1930, inclusive, showed an increase, with 397,789 oz. of gold, 5,871,644 oz. of silver, 75,615 tons of copper, and 56,324 tons of sulphur, as compared with 330,709 oz. of gold, 5,346,062 oz. of silver, 69,267 tons of copper, and 71,230 tons of sulphur in the twelve-month period September, 1928, to August, 1929, inclusive. The different mines maintained their respective position in regard to output. No important ore discoveries were recorded and no extensions to existing plants were made during the year.

Reports of the discovery of gold placers of great magnitude on the eastern coast of the island of Formosa caused some excitement, but the reports were not confirmed. No decision has yet been made regarding the site for the much-discussed Showa Steel Works, in Manchuria. The business depression that has held the Empire in its grip during the year has shown no sign of yielding.

Industrial Progress

Many Equipment Lines Active

DESPITE the prevailing economic situation, a generous variety of equipment having application in mining and metallurgical work was introduced in 1930. Especially was this true of material-handling lines, including conveyors, haulage and hoisting equipment, and power shovels. In electrical lines, manufacturers of instruments displayed marked activity. In general, the development of new equipment seems to have proceeded at its normal pace. A summary follows:

Drills. The Diamond Core Drill Manufacturers' Association was organized in the United States and initiated a program of simplification and standardization, adopting commercial standards for North America for core-drill fittings. Sullivan Machinery Company, Chicago, brought out two new core drills, one a gasoline-engine (54-hp.)-driven, portable unit, capable of drilling to 3,000 ft. with 2-in. core fittings; the other a light (900-lb.) portable drill, driven by a 6-hp. gasoline engine and capable of taking a $\frac{13}{16}$-in. core to 300 ft. Mitchell Diamond Drill Contracting Company, San Francisco (formerly International Diamond-Drill Contracting Company), developed a one-man diamond drill weighing 160 lb., which will fit any standard rock-drill bar and clamp. It will take a $\frac{13}{16}$-in. or $\frac{3}{4}$-in. core to 150 ft.

In the rock-drill field, Worthington Pump & Machinery Corporation acquired the Gilman line of rock drills, heat-treating machines, furnaces, and accessories. Some new drills appeared. A light, fast, one-man stoper, the rotation of which can be "tripped" or interrupted to facilitate collaring a hole, was introduced by Cleveland Rock Drill Manufacturing Company, Cleveland, Ohio; also, a light sinker. The Sullivan company, Chicago, brought out a one-man automatic, rotating water stoper, taking 1-in. quarter-octagon steel up to 10 ft., for heavy work in hard rock; three mounted hammer drills, weighing 122, 159, and 190 lb. respectively, for any kind of mounting in any service; a 39-lb. general purpose rotator hammer drill; also a self-propelled track-mounted drill, driven by an 8½-hp. geared motor and using auger-type steel with fishtail bits for soft formations.

Ingersoll-Rand, New York, developed in 1930 a new line of shank and bit punches to fit its No. 34 sharpener, enabling it to handle any section of steel up to 1⅛ in. diameter and to make bits up to 2½ in. in diameter.

Compressors. Worthington corporation developed a positively operating, single-automatic-diaphragm type of governor for controlling the entire unloading cycle on its five-step, variable-capacity compressors. Gardner-Denver Company, Denver, Colo., brought out a 26-cu.ft. single-stage, air-cooled compressor, mounted with a 5-hp. motor on a cast-iron base on top of an air receiver. Among the machines introduced by the Sullivan company were: a line of "angle" Diesel-driven semi-portable compressors; a 66-cu.ft. "vibrationless" portable unit; two single-cylinder, stationary, vertical compressors, 5½x5 in. and 6½x5¼ in. respectively; two new types of high-pressure (400-lb. maximum) machines of 55 to 150 cu.ft. capacity. This company also secured sales rights for so-called Tanner tanks and gas, which functions to prevent freezing in compressed-air lines and around air-tool exhausts.

Explosives. Further expansion of low-density ammonia powders was reported by du Pont; also that more plastic dynamites are replacing low-grade gelatins. Du Pont also introduced free-running quarry powders which can be poured directly into the hole; and announced that blasting gelatin can be had on the low-freezing basis. Hercules Powder Company, Wilmington, improved its small ten-cap blasting machine, making it more proof against moisture and dust. Burton Explosives, Inc., prepared to manufacture high explosives near New Castle, Pa., on an initial scale of 12,000,000 lb. a year.

Haulage. Atlas Car & Manufacturing Company, Cleveland, Ohio, built for an Eastern mining company a compact, 4-ton, 24-in. gage locomotive, specially protected against moisture and carrying a battery of 80 Edison A 8 cells, exceptionally large for a locomotive of this rating; also a 50-ton locomotive equipped with a battery of 200 MVA-41 Exide Ironclad cells.

A line of eleven sizes (4 to 25 tons) of gas-engine-driven locomotives was contributed by Midwest Locomotive Works, Ohio. Fate-Root-Heath Company, Plymouth, Ohio, developed a new line (25 to 60 tons) of gas-electric and oil-electric locomotives. Similarly, Vulcan Iron Works, Wilkes-Barre, Pa., introduced a line (10 to 80 tons) of gas-electric locomotives in four-wheel and eight-wheel types and in all practical gages. Two oil-electric locomotives (80 to 90 tons) in a 0-8-0 rigid wheel-base type were brought out by George D. Whitcomb Company, Rochelle, Ill., which company also produced other oil-electric units in a four-wheel type, as well as a 0-4-4-0 double-truck unit. Brookville Locomotive Company, Brookville, Pa., contributed two new series of locomotives in 2- to 4-ton sizes, powered with the Ford AA truck engine.

To demonstrate the value of anti-friction bearings on railway locomotives, the Timken Roller Bearing Company, Canton, Ohio, completely equipped a 711,500-lb. (with tender) 4-8-4 locomotive, of the American Locomotive Company, with Timken bearings, for testing under operating conditions.

Haulage accessory equipment was varied in character. National Electric Light Association announced a new standard section for trolley wire heavier than the 4/0 size regularly used in the past. Ohio Brass Company, Mansfield, Ohio, introduced a trolley frog to take large wires without bending or preforming—this to meet the increased use of 6-0 trolley wire; an incandescent type of motor headlight (Type MS) for use where the voltage is fairly uniform; a dual feeder and trolley suspension using a single suspension point and one insulated hanger to carry both trolley wire and feeder—this for any size of feeder wire from 6/0 to 1,000,000 circ. mils; a pipe adapter for high and irregular haulageway roofs; a section insulator with an all-metal underrun; a universal harp for all angles of the trolley pole up to that necessary for a wire 6 ft. overhead; a K-type air-gap mine hanger for all currents up to 550 volts; and a time-limit circuit-breaker switch which gives the machine complete protection and is able to withstand overloads for a few seconds to twenty minutes. A straight-line hanger (Type CD) having a replaceable, insulating portion; a drop-forged double-curve pullover, and a single-curve pullover were introduced by Electric Railway Equipment Company, Cincinnati, Ohio.

General Electric supplied the United States Smelting Company's Bingham (Utah) mine with a fully automatic panel for controlling the charging of batteries on three haulage levels. The Syntron Company, Pittsburgh, with Westinghouse, turned out a portable gasoline-motor-driven-generator power unit for operating two- to twelve-tie tampers, or for supplying power to other portable tools. Ohio Electric Manufac-

turing Company, Cleveland, turned out a special magnet for handling single 30-ft., 130-lb. railroad rails.

Transport, Conveying. Differential Steel Car, Findlay, Ohio, introduced its so-called "Differential" train for waste disposal and stockpiling, combining in it an electrically motorized side-dumping car and one or more trailing 10-cu.yd. cars, the end car dumping over the end as well as to either side; also, a motorized car, having an internal-combustion engine, complete control and driving equipment, and an automatic dump body, the tractive effort when loaded and empty being automatically regulated. The company also brought out a simply-built, all-steel, two-way-dump mine car of low height, and requiring a separate device for dumping.

Western Wheeled Scraper Company, Aurora, Ill., following the success of the standard-gage drop-door air-dump car, introduced a car of similar design but of 36-in. gage and 10 cu.yd. capacity, for stripping and mining work. Sanford-Day Iron Works, Knoxville, Tenn., brought out a car of "cantilever" construction for rotary or end dumping; also a cantilever end-dump car with a patented end gate, both cars in a wide range of capacities; and an improved car wheel and a simplified brake.

An automatically controlled railway using riderless side-dumping cars, built by Atlas Car & Manufacturing Company, was installed at a Texas cement plant for transferring rock from quarry to crusher. The electric equipment and control method employed were products of the General Electric Company. The Interstate Equipment Corporation, New York, installed an automatic cable tramway system at a Georgia clay working plant to dispose of overburden.

An all-steel mine-inspection car, which will carry, at 7 miles per hour, four to six men besides the operator, sitting, or two and the operator, reclining, was introduced by Jeffrey Manufacturing Company, Columbus, Ohio.

Adolf Bleichert & Company, Leipzig, secured German patents to the following: a device for keeping conveyor belts in position to save their edges; a conveyor arrangement in briquette plants for feeding coal from bins to dryer; a measuring apparatus in form of a suspended ropeway car for removing smaller amounts from small bins; a new cable drive for closely regulating speed of scraping with cable excavators (the most modern installation, Viktoria III, at Senftenberg, Niederlausitz, is so equipped); an improved cable-scraper bucket, permitting safe emptying from behind; a bucket, and a means for cleaning it, for sticky, heavy material; an improved wire-rope-tramway running roller giving minimum wear and greater safety; an aërial tramway, with one station movable in a half-circle, the other permitting loaded and empty lines to cross, one rope and one drive only being required; also a new method of disconnecting the drive in a passenger aërial tramway.

Activity was marked in conveying lines. Stephens-Adamson Manufacturing Company, Aurora, Ill., introduced a roller-bearing belt-conveyor take-up bearing, in sizes having a maximum travel of 24 to 54 in. and suitable for 1 1/8- to 4 1/8-in. shafts; also a three-roller, 20-deg. trough, Timken-equipped belt-conveyor carrier for 18- to 48-in. belts; also a belt-conveyor tripper of 700 tons' per hour capacity, having a sturdy two-way discharge spout and built for a 42-in. belt. A heavy-duty five-pulley idler for use with the heaviest conveyor belt ever made was constructed by Stearns Conveyor Company, Cleveland, Ohio. A standardized drive, in two types, for 8- to 16-in. screw conveyors, was developed by Link-Belt Company's subsidiary, H. W. Caldwell & Son Company, Chicago.

A water-jacketed 12-ft. tubular vibrator conveyor for handling hourly 200 tons of material as hot as 2,000 deg. F. was introduced by Traylor Vibrator Company, Denver, Colo.; also a screening conveyor for handling calcines. The company likewise devised a vibrating pan feeder of 200 tons' hourly capacity, for use in hung or mounted type on ordinary a.c. circuits. Rights to a rotary, tubular, screw-flight conveyor (invented by F. C. Jacoby) for handling hot, dusty, or abrasive materials, were secured by Hardinge Company, New York. Hardinge also designed a new type of constant-weight feeder for feeding coarse materials at varying capacities, and also for feeding moist sticky materials without clogging. For handling bulk granular material a comparatively short distance, a compact, efficient shaker-conveyor drive was developed by Conveyor Sales Company, New York.

Improved conveyor and drive chains were developed in 1930. Link-Belt Company brought out a new cast metal, "Promal," of unusual qualities for this purpose; also a superior chain ("Hyper") of alloy steel. Jeffrey Manufacturing Company, Columbus, Ohio, produced a wear-resisting metal, "Supermal," for chains and buckets; also buckets and chains of it. American Manganese Steel Company introduced a new type of conveyor and drag with manganese-steel links of improved design. A bucket-elevator chain having rollers, side links, and pins of manganese steel was brought out by the Manganese Steel Forge Company, Philadelphia.

A self-vulcanizing rubber compound ("Covulc") was developed by the Hitchcock Company, Boston, for resurfacing conveyor belts, covering pipes and shafts, and lining chutes and tanks. James C. Heintz Company, Cleveland, Ohio, contributed an electrically heated, portable vulcanizer for belts. What is said to be the heaviest and thickest conveyor belt ever made was produced in 1930 by the Robins Conveying Belt Company, New York, for handling material of 15-in. maximum size. It is 1 3/4 in. thick, 54 in. wide, and has 16 plies at the sides and 14 in the center. A 30-hp. crawler bucket loader with a continuous helical-ribbon feeder was devised by Link-Belt. A heavy-duty box car loader of 350 tons' hourly capacity was brought out by Stephens-Adamson.

Four 55-in. (diameter) magnets having special features were built by Ohio Electric Manufacturing Company, Cleveland, for picking tramp iron from the 48-in. conveyor belts of Anglo-Chilean Nitrate Corporation.

Hoisting. Perhaps the outstanding development in hoisting practice in 1930 was the adoption of light metals such as aluminum and duralumin, to cut down equipment weight. Demag, Duisburg, Germany, offered multiple-deck mine cages built of duralumin, affording in their lightness a solution of certain hoisting problems. Six 10-ton overhead traveling cranes, constructed largely of aluminum alloy, were built by Northern Engineering Works, Detroit, Mich., for the U. S. Aluminum Company, Alcoa, Tenn. Total weight is 30,000 lb., a saving of 47,100 lb. attributable to use of light metal in place of steel.

Ingersoll-Rand, New York, introduced for scraping and dragline work a double-drum electric (a.c. or d.c.) hoist, with all working parts inclosed and rigidly supported by a cylindrical steel housing, insuring perfect alignment under all conditions. The company also added a 2,000-lb. model to its line of "Utility" hoists, previously introduced in capacities up to 1,500 lb. This type has a radial reversible air motor.

Besides several new hoists, a heavy, sturdily built, roller-bearing sheave, or tail block, in 8-, 10-, and 12-in. diameters, was introduced by Sullivan for slushing. Sauerman Bros., Chicago, added a new dragline block with a 6-in. sheave to their "Durolite" line. Manganese Steel Forge Company, Philadelphia, brought out a new type of chain made of rolled and forged manganese steel, for opening and closing clamshell and orange-peel buckets.

A new line of small high-speed electric hoists, ¼ ton to 10 tons in size, was introduced by Harnischfeger Corporation's Milwaukee Electric & Crane Hoist Division. A magnetic-contactor dy-

namic-braking controller, for crane hoists, was brought out by Electric Controller & Manufacturing Company, Cleveland. General Electric devised a pendant-type push button for controlling small operated cranes, to supersede rope-and-chain control. Cutler-Hammer, Milwaukee, developed an automatic lift-magnet controller, with an automatic drop. To the automatic loaders used with its skip hoists Link-Belt Company, Philadelphia, added one that prevents the hoist from operating unless there is enough material in the hopper to fill the skip.

Power Shovels. Excavators that appeared in 1930 included six brought out by Bucyrus-Erie. These were a 2½-yd. convertible Diesel shovel with extra-size caterpillar mountings, and a 4-cycle, 6-cylinder Atlas-Bucyrus-Erie full-Diesel engine; a 5-yd. full-revolving quarry and mine shovel; a 1½-yd. sturdily built and fast steam shovel; two convertible gasoline clamshells, 1 yd. and ⅝ yd. respectively; and a railway crane able to handle 200 tons in a 17½-ft. radius. This company also improved the caterpillar mounting of its E 2 Diesel dragline.

By placing the motor of its standard ¾-, 1-, and 1¼-yd. electric shovels at the front of the platform instead of at the rear of the turntable mechani[illegible] to lessen their tail-swing clearan[illegible] the Thew Shovel Company, Lorain, [illegible], adapted them for underground use. Harnischfeger Corporation, Milwaukee, added seven new models of excavators (electric, Diesel, or gasoline), all convertible except one, giving a size for every requirement from ½-yd. to 3½-yd. capacity. The Nordberg-Butler shovel was equipped with an all-steel crawler-mounting by Nordberg Manufacturing Company, Milwaukee.

American Manganese Steel Company, Chicago Heights, Ill., produced the Meyer turtleback, a manganese-steel casting for reinforcing dipper doors. It also secured a license to make the Voit dipper front, which has provision on it for several scraper blades to clean the pit in stripping and protect the latch from mud. The company also made a 37-ton all-manganese-steel 15-yd. dipper for the Union Electric Coal Company's electric shovel at Danville, Ill.

Pumping. Develoments included a 25-stage deep-well turbine pump, 864 ft. from top of motor to bottom of bowls, built by Pomona Pump Company, California. Rubber lining continued to receive attention. Oliver United Filters Corporation, San Francisco, added a 1½-in. model to its line of Olivite-lined centrifugal pumps. American Hard Rubber Company, New York, introduced acid-resisting solid-rubber and rubber-lined pipes and fittings.

The vertically split centrifugal pump, with solid diaphragms to prevent internal leakage, is now firmly established as the proper solution to the problem of the highest-pressure boiler feeding. Worthington corporation installed many units of this type to deliver from 200,000 to 900,000 lb. of water per hour against pressures of from 1,300 to 1,600 lb. per square inch. Chicago Pneumatic Tool Company, New York, brought out a 44-lb. 100-g.p.m., air-driven sump pump (Quimby), which can be driven by a portable compressor.

Crushing, Grinding. To secure a large capacity with a much greater ratio of reduction than has hitherto been possible in a gyratory, Traylor Engineering & Manufacturing Company, Allentown, Pa., produced a 15-in. reduction crusher with curved heads and concaves to give a small discharge opening and a large feed opening. Choking or stalling is minimized by the use of heavy outside springs which allow the head to be forced downward to release the obstruction. These heads and concaves may be installed in any existing gyratory, whether of standard or reduction type.

The principle of the hammermill, the hammers being rigid and mounted on a rotor making 1,000 r.p.m., was adapted in a crusher developed by Western Wheeled Scraper Company, Aurora, Ill. Feed that escapes being broken is forced between the hammers and a fixed die. Stedman Foundry & Machine Works, Aurora, Ind., introduced a new line of swing- and ring-type hammermill crushers and pulverizers, comprising three types and 25 sizes ranging from 5 to 250 hp. Williamson Company, San Francisco, reported an increase in number of its standard grinding mills, and that it had found advantageous a still greater reduction in operating speed. Straub Manufacturing Company, Oakland, Calif., introduced a small all-steel Rib-Cone mill, with changeable-head feature and a built-in classifier, which is offered as a thoroughly practical mill for pilot, prospecting and test work.

For laboratory work, a 12x24-in. convertible unlined ball-rod-tube mill, with interchangeable cylinders of thick, hard, cast iron, was brought out by Denver Equipment Company, Denver: also a 7x14-in. rod mill and a roll crusher.

For grinding limestone, talc, and similar materials, at rates of 500 to 2,000 lb. per hour, Combustion Engineering Corporation, New York, introduced the Raymond Midget (No. 1 roller) mill, also intended for pulverizing coal (1,000 to 4,000 lb. per hour) for direct firing of furnaces and kilns. Fuller-Lehigh Company, in an effort to produce a more efficient fuel pulverizer, brought out an air-separation ball mill (Type B), said to retain all desirable features of the Lehigh mill. A 40-ton unit (largest in the world), driven by a 500-hp. vertical synchronous motor at 72 r.p.m., was built for a public utility company.

Rubert M. Gay Company, New York, arranged the top of the separating chamber of its air separator so that the openings can be adjusted from the outside to take care of materials of different specific gravities and to make small changes in size of product.

Weighing. The Richardson Scale Company, Passaic, N. J., introduced a larger size of its "Convey-O-Weigh," with 200 tons' hourly capacity. Poidometers in smaller sizes with capacities of 1 to 100 lb. per minute were produced by Shaffer Poidometer Company, Pittsburgh, Pa.

Screening. A so-called "Centrifugal" vibrating screen, driven by a V-belt from an inclosed fan-cooled squirrel-cage motor, was introduced by Allis-Chalmers in single- and multiple-deck types. Vibration is produced mechanically and transmitted equally over the screen surface. Huron Industries, Inc., Alpena, Mich., brought out a line of mechanically vibrated screens for grading coarse materials. Deister Concentrator Company, Fort Wayne, Ind., improved its Leahy vibrating screen and provided a guard for the vibrator mechanism. A rotating screen with four 30-in. sieves, and intended for testing large samples of coarse aggregate accurately, was developed by Hendrick Manufacturing Company, Carbondale, Pa. Deister Machine Company, Fort Wayne, Ind., improved its Plat-O vibrating screen.

Ludlow-Saylor Wire Company, St. Louis, brought out a woven-wire screen of spring steel for hard service on revolving, vibrating, shaking, or gravity screens. Manganese Steel Forge Company, Philadelphia, developed a fine-mesh double-crimped screen cloth of (Rol-Man) manganese-steel wire, which gives a resilient screening surface.

Concentration. Sodium "Aerofloat" flotation reagent was introduced by American Cyanamid Company, New York, for use where independent control of promoter and frother is desired. To facilitate feeding reagents that require heat, Denver Equipment Company developed a feeder inclosed to exclude air and moisture and to remain at constant temperature inside; also a "multi-compartment" feeder for feeding a number of different reagents accurately at the same time. It also developed a compact type of the Denver Sub A flotation machine, requiring low head room; and improved its conditioner and agitator. Ruth Company, Denver, Colo., developed its "gradient" flotation in cast iron in six sizes from 6 to 32 in.

In the field of magnetic separation, Magnetic Manufacturing Company, Milwaukee, Wis., developed in 1930 a separator capable of treating highly reluctant magnetic material efficiently. Cutler-Hammer, Milwaukee, contributed an improved 12-in. magnetic separator-pulley in six lengths.

Washing. For washing gravel or

crushed quarry products of 3½-in. maximum size, Smith Engineering Works, Milwaukee, introduced a steel log washer (Telsmith) with a capacity of 35 to 50 cu.yd. per hour; also, for dewatering sands, a complete self-contained sand drag in four sizes and capacities ranging from 24 to 60 cu.yd. per hour.

Filtration. Oliver United Filters Corporation, San Francisco, installed a 2½x1-ft. (face) Oliver filter at the Bunker Hill & Sullivan mill, Kellogg, Idaho, for handling granular lead and iron table concentrate. Filtering surface was Palma twill held by wire spaced 1½ in. Denver Equipment Company supplied a 12-in. diameter "pressure" filter for handling large samples in the laboratory. A laboratory filter was introduced by Ruth Company, Denver.

Rubber Applications. Rubber in sheets, made in the Malay States directly from latex at or near source of production and having a superior ability to resist abrasion and aging, was introduced in the United States by Wilkinson Process Rubber Sales Corporation, Chicago. The Dorr Company, New York, adopted the B. F. Goodrich Thermoprene process for applying rubber to steel, in rubber-lining its equipment.

Franz Clouth Company, Köln-Nippes, Germany, introduced chemically resistant, porous, hard-rubber pipes, filter rings, and filters for work at temperatures not over 70 deg. C. with liquids that will not dissolve rubber or make it swell, in place of filter cloth and filters of earthenware and other materials; also plate diaphragms of the same material for electrolytic work, which, because of thinness and variable permeability, offer less resistance to electric current than diaphragms commonly used; also an iron filter press covered with porous hard rubber and using leaves of the same material.

Furnaces, Kilns. A fuel- and labor-saving machine, patterned after the foundry sandslinger, was announced by Beardsley & Piper Company, Chicago, for charging Belgian zinc retorts. Mines Equipment Company, St. Louis, introduced the Miller rotary dryer, having a 20-ft.x36-in. drum and a double-screw conveyor feeder with broken flights, for drying lead flotation concentrate, sand, coke, bauxite, and similar materials, using low-pressure burners. Hardinge introduced a new Ruggles-Coles rotary dryer to handle flotation concentrate without balling. Four types of industrial gas-burning appliances were introduced by Denver Fire Clay Company, Denver, to solve problems met in burning artificial or natural gas.

A clean, compact, electrically heated laboratory furnace, having replaceable heating elements and capable of developing a temperature of 1,500 deg. C., was developed in the Research Laboratory of Carborundum Company, Niagara Falls, N. Y.

Harbison-Walker Refractories Company, Pittsburgh, Pa., improved some existing products, principally to secure uniformity in both physical and chemical properties. In a number of instances, high-alumina brick were used successfully in replacing fireclay brick where high temperatures and slag action had

been severe. General Refractories Company, Philadelphia, also improved some products.

Dust Recovery. Recovery of valuable fume, and obviation of a troublesome health hazard in a crowded community, were achieved at H. Kramer & Company's scrap-metal smelter, Chicago, in 1930 by installing a Dracco fume-precipitation system, embodying spray-cooling of the gases from the lead and brass furnaces, followed by filtering through woolen bags in a plant of more modern design than the familiar bag-house. Dust Recovering & Conveying Company, Cleveland, Ohio, the manufacturers, spent much effort in completing the successful adaptation of its filters to secondary smelters, in general.

Western Precipitation Company, Los Angeles, completed several installations of electrical precipitation equipment in Canadian metallurgical plants; also one for lead blast furnace and sintering machine gases at Mount Isa, Australia. It introduced a highly efficient, mechanical dust collector, the "Multiclone," for use where the Cottrell process cannot be applied because of combustible mixtures or small size of installation.

Sampling. An electric, motor-driven Scobey sampler, timed to take a sample every 8 min., was brought out in 1930 by the Mine & Smelter Supply Company, Denver, Colo.

Laboratory. Braun Corporation, Los Angeles, made minor improvements in its laboratory equipment. Mine and Smelter Supply Company, introduced a laboratory size (¼-hp. motor) Wilfley table. Other equipment for test work has been noted under other headings. U. S. Stoneware Corporation, New York, developed an improved gas generator.

Blowers, Fans. De Laval Steam Turbine Company built in 1930 what is believed to be the largest blast-furnace blower in the United States—a 115,000-cu.ft. (against 30-lb. pressure) single-suction, five-stage centrifugal compressor, directly coupled to an impulse pressure stage steam turbine running at 2,600 r.p.m. Escher Wyss Company, Zurich, Switzerland (United States representatives, National Power Machinery Corporation, New York), supplied Tata Iron & Steel Company, India, with two 130,000-cu.ft. (27-lb. gage) steam-driven turbo blowers for the Tata company's new blast furnaces. A small high-speed portable mine fan, of aluminum, was introduced by American Blower Corp., Detroit, Mich.

Power Plant. Worthington modified its folded-tube bank of condenser design slightly by adding steam entrance lanes in the natural path of flow between inlet and exit lanes. Tests on a condenser embodying this feature show that overall condenser pressure drop has been decreased 40 per cent, with correspondingly higher vacuums at turbine exhaust. Worthington also applied the open-type feed-water heater to higher pressures by adopting cylindrical heater sections having a minimum of joints. Erie City Iron Works, Erie, Pa., introduced a series of low headroom three-drum boilers, 80 hp. and up, for working pressures up to 350 lb.

General Electric produced a small, mechanically driven single-stage non-condensing steam turbine for driving centrifugal pumps, fans, and similar apparatus, running at speeds of 1,750 to 3,600 r.p.m.; also one for steam pressures up to 250 lb. and speeds between 1,200 and 1,400 r.p.m. with capacities up to about 250 hp.

Internal Combustion Engines. Worthington, in certain of its crosshead-type two-cycle Diesel engines, replaced in 1930 the divided combustion chamber with direct injection and used individual fuel pumps for each cylinder, this giving improved fuel economy and better load-carrying capacity. Climax Engineering Company, Clinton, Iowa, introduced a line of five sizes (70-200 hp.) of distillate engines with chrome-nickel-iron cylinders.

A fully inclosed, fly-ball-type speed governor, with mechanism for giving warnings and operating controls at remote points, was introduced by Duro Metal Products Company, Chicago, makers of the Lilley hoist control.

Electrical Machinery. Fairbanks Morse broadened its line of synchronous motors in ratings from 20 to 10,000 hp. in 1930. Reliance Electric & Engineering Company, Cleveland, Ohio, used the Mossay principle of cooling in the larger sizes of a new line (20-150 hp.) of fully inclosed fan-cooled induction motors, and introduced bright-colored d.c. motor windings. It also brought out a motor-generator set with a heavy, welded, steel-plate base, and with top and

ends completely inclosed. General Electric introduced an edgewise-wound heavy-duty resistor of unit-box type in twenty sizes covering current range from 22 to 136 amp. and resistance of 2½ to 0.058 ohms. Westinghouse developed a sealed-sleeve motor bearing housed to keep dirt out and lubricant in.

Mercury arc rectifiers of 16,500 kw. capacity were installed in the Consolidated electrolytic zinc plant, Trail, B. C., by the American Brown Boveri Company, which company also planned 13,000-kw. rectifier capacity for producing electrolytic hydrogen in the first-named company's new nitrogen fixation plant.

Brown Instrument Company announced in 1930 the De Florez system of controlling plant valves from a remote convenient point, using Selsyn (G. E.) motors.

Power Transmission. Falk Corporation, Milwaukee, brought out a line (⅛ hp. to 100 hp. at 100 r.p.m.) of right-angle speed reducers (ratios 1.5:1 to 518:1) including horizontal- and vertical-shaft types, combining single helical and spiral bevel gears. Westinghouse-Nuttall devised for the Perth Amboy smelter a unique gear unit assembly to obtain the speed reduction required on a heavy-duty agitator drive, using a 20-hp., 1150-r.p.m. motor. It also introduced twelve sizes of speed reducers in both standard single- and double-reduction types, giving 28 standard reduction ratios (2.82:1 to 70.5:1, and from 1 hp. to 635 hp.). Stephens-Adamson Manufacturing Company, Aurora, Ill., brought out in 1930, in sizes to deliver ¼ to 7½ hp., a variable-speed drive unit combining in a single housing a JFS variable speed reducer, electric drive motor and speed control.

Link-Belt Company, Chicago, in 1930 secured American and Canadian rights to the P.I.V. gear. Worthington developed a V-belt drive in conjunction with Goodyear Tire & Rubber Company, using belts of the latter's Emerald Cord make. Cutler-Hammer brought out an improved magnetic clutch. Graton & Knight, Worcester, Mass., introduced unique leather-belt-making machinery capable of making better belting by eliminating the human equation.

Bearings. S K F Industries in 1930 introduced a ball bearing with an integral felt seal, requiring only the housing inclosure to complete it. Westinghouse Research Laboratories invented a self-lubricating bearing metal. Link-Belt Company brought out an improved anti-friction ball-and-socket pillow block for any good grade of commercial shafting, from 1⅛ in. diameter up.

Lighting. National Carbon Company, Cleveland, developed a new carbon arc lamp affording a close reproduction of natural sunshine and adaptable for group irradiation. Mine Safety Appliances Company, Pittsburgh, introduced an improved Edison (Model H) miner's cap lamp. A safety lighting cable (Stringalite) for severe service underground was developed by the Sullivan Machinery Company; also a line of portable (Sullite) lighting plants. Hazard Insulated Wire Works, Wilkes-Barre, Pa., brought out in 1930 a rubber-jacketed, trailing power cable for mine machinery, and a non-inductive spiral-woven cable for mine light and power circuits.

A wide variety of switches and controlling devices appeared in 1930. Producers in this field included: General Electric, Westinghouse, Ohio Brass, Cutler-Hammer, Reliance Electric & Engineering, Cleveland Electric

Controller & Manufacturing Company, Monitor Controller Company, and Delta-Star Electric Company.

Instruments. Brown Instrument Company, Philadelphia, developed a manometer, used with its electric flow meter, for measuring flow of gas or air at pressures not exceeding 50 lb.; a manometer for pressures as high as 5,000 lb.; a float-operated liquid-level gage, operated on the inductance-bridge principle with a remote indicating or recording meter for heavy viscous fluids; a remote-type pressure gage; and an improved automatic indicating controller in the form of either a pyrometer, resistance thermometer, or tachometer. Foxboro Company, Foxboro, Mass., developed a special, chrome-molybdenum steel alloy for the helical and Bourdon springs of its recording and indicating gages. Weston Electrical Corporation, Newark, N. J., introduced an instrument for measuring heat flow, comprising, in part, a thermocouple and a sensitive millivoltmeter. The Meriam Company, Cleveland, announced a U-tube manometer for indicating simultaneously line pressure and rate of flow of gases or liquids in pipe lines; it also improved the method of mounting pressure and flow instruments of the manometer type on switchboards. Uehling Instrument Company, Paterson, N. J., brought out a potentiometer pyrometer for recording high temperatures accurately and so made that the galvanometer may be placed any distance from the recorder. O. Zernickow Company, New York, developed an instrument for showing instantaneously the velocity of an air or gas current and its fluctuations in miles per hour and meters per second. General Electric introduced a quartz-rod thermostat for controlling the temperature of soft-metal melting pots.

Westinghouse announced new applications of the photo-electric cell, especially for temperature and lighting control; also a new frequency meter permitting production of instruments for use on 60-cycle systems. General Electric brought out, for a.c. and d.c. circuits, a line of voltmeters (2-150 v.) and milliammeters (0.5 to 1.5 milliampere) of the d'Arsonval type with a full-wave copper-oxide rectifier mounted within the case. Roller Smith Company, New York, entered the graphic instrument field with two lines, in switchboard, wall and portable models, for a.c. and d.c. work, and introduced a d.c. volt-ohmmeter (Type PD). Sangamo Electric Company, Springfield, Ill., developed a kilovolt-ampere-demand meter giving a diversity of information relative to load on a single chart.

Electrocon Corporation, New York, announced in 1930 equipment, utilizing the stroboscopic principle, for diagnosing cases of machine unbalance and correcting the trouble. Industrial Apparatus & Instrument Company, Newark, N. J., introduced an indicator developed by Vulcan Works, Gutersloh, Germany, for detecting and determining individual gases in a gas-air mixture.

Welding. New equipment of various sorts appeared, the manufacturers including Westinghouse, Lincoln Electric, General Electric, Oxweld Acetylene, and Fusion Welding Corporation. Linde Air Products Company introduced a new method of oxy-acetylene welding, successful in overload pipe-line construction. General Electric brought out equipment for brazing by means of the heat generated by flow of electricity through carbon blocks.

Engineering Office. A simple and effective device for reproducing irregular profiles was introduced from Great Britain in the Maco templet by American Maco Template Company, New York.

Miscellaneous. "Maizolith," a new cellulose product, used for making noiseless gears, rods, wheels, bearings, and like parts, was announced in 1930 by the U. S. Bureau of Standards. "Prodorite," an acid-resistant material, made of quartz and pitch, for lining vats, launders, pipe lines, was developed by the Prodorite Company, Pratteln, Switzerland. An acid and corrosion-resistant alloy, "Hastelloy," was introduced in 1930 by the Haynes Stellite Company of Kokomo, Ind.

Mining Directory

Professional Organizations

American Association of Petroleum Geologists, Box 1852, Tulsa, Okla.

American Chemical Society, 1709 G St., N.W., Washington, D. C.

American Electrochemical Society, Columbia University, New York.

American Institute of Mining and Metallurgical Engineers, 29 West 39th St., New York.

American Society for Testing Materials, 1315 Spruce St., Philadelphia, Pa.

Australasian Institute of Mining and Metallurgy, 48 Queen St., Melbourne, Victoria, Australia.

Canadian Institute of Mining and Metallurgy, Drummond Building, Montreal, Quebec, Canada.

Chemical, Metallurgical and Mining Society of South Africa, 100 Fox St., Johannesburg, Transvaal, South Africa.

Deutsche Metallhütten und Bergleute, Lützowstrasse 89/90, Berlin, W. 35, Germany.

Geological Society of America, Museum of Natural History, Columbus Ave. and 77th St., New York.

Geological Society of London, Burlington House, London, W., England.

Geological Society of Washington, U. S. Geological Survey, Washington, D. C.

Institution of Mining and Metallurgy, 225 City Road, London, E. C. 1, England.

Mining and Geological Institute of India, 27 Chowringhee, Calcutta.

Mining and Metallurgical Society of America, 2 Rector St., New York.

Société des Ingénieurs Civils de France (Division of Mining and Metallurgy), Hôtel de la Société, 19 Rue Blanche, Paris, France.

Society of Chemical Industry, Central House, Finsbury Square, London, E. C. 2, England; Pratt Institute, Brooklyn, New York.

Society of Economic Geologists, Guyot Hall, Princeton University, Princeton, N. J.

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Educational Institutions

United States:

Alabama—Mine Experiment Station, University of Alabama, University, Ala.; J. R. Cudworth, acting director.

Alaska—Alaska Agricultural College and School of Mines, College, Alaska; C. E. Bunnell, president.

Arizona—College of Mines and Engineering, University of Arizona, Tucson, Ariz.; G. M. Butler, dean.

California—College of Mining, University of California, Berkeley, Calif.; F. H. Probert, dean. School of Engineering, Department of Mining Engineering, Stanford University, Palo Alto, Calif.; Theodore J. Hoover, dean.

Colorado—Colorado School of Mines, Golden, Colo.; M. F. Coolbaugh, president.

Connecticut—Department of Mining and Metallurgy, Yale University, New Haven, Conn.; C. H. Mathewson, professor of metallurgy; Arthur Phillips, associate professor of metallurgy; R. K. Warner and H. A. Behre, assistant professors of mining.

Idaho—School of Mines, University of Idaho, Moscow, Idaho; John Wellington Finch, dean.

Illinois—Mining Engineering Department, University of Illinois, Urbana, Ill.; A. C. Callen, head.

Iowa—Mining Engineering Department, Iowa State College, Ames, Iowa; Prof. A. K. Friedrich.

Kansas—Department of Mining Engineering, University of Kansas, Lawrence, Kan.; Prof. C. M. Young, head.

Kentucky—Department of Mining and Metallurgical Engineering, C. S. Crouse, head; University of Kentucky, Lexington, Ky.

Massachusetts—Department of Mining and Metallurgy, Massachusetts Institute of Technology, Cambridge, Mass.; W. Spencer Hutchinson, professor of mining, in charge of the department. Harvard Engineering School, Department of Mining, Harvard University, Cambridge, Mass.; D. H. McLaughlin, professor of mining engineering.

Michigan—Michigan College of Mining and Technology, Houghton, Mich.; W. O. Hotchkiss, president.

Minnesota—School of Mines and Metallurgy, University of Minnesota, Minneapolis, Minn.; W. R. Appleby, dean.

Missouri—Missouri School of Mines and Metallurgy, Rolla, Mo.; Dr. C. H. Fulton, director.

Montana—Montana School of Mines, Butte, Mont.; Francis A. Thomson, president.

Nevada—Mackay School of Mines, University of Nevada, Reno, Nev.; J. A. Fulton, director.

New Jersey—School of Engineering, Princeton University, Princeton, N. J.; A. M. Greene, Jr., dean.

New Mexico—New Mexico School of Mines, Socorro, N. M.; E. H. Wells, president.

New York—School of Engineering (including the School of Mines), Columbia University, New York, N. Y.; Joseph W. Barker, dean. Department of Geology, Cornell University, Ithaca, N. Y.; Prof. H. Ries, head.

North Dakota—College of Engineering and School of Mines, University of North Dakota, Grand Forks, N. D.; E. F. Chandler, dean.

Ohio—Department of Metallurgical and Mining Engineering, Case School of Applied Science, Cleveland, Ohio; H. M. Boylston, professor. Department of Mine Engineering, Ohio State University, Columbus, Ohio; H. E. Nold, professor.

Oklahoma—College of Engineering, University of Oklahoma, Norman, Okla.; J. H. Felger, dean. Oklahoma School of Mines and Metallurgy, Wilburton, Okla.; E. E. Tourtellotte, president.

Oregon—School of Mines, Oregon State College, Corvallis, Ore.; J. H. Hance, dean.

Pennsylvania—Department of Mining and Metallurgy, Carnegie, Institute of Technology, Schenley Park, Pittsburgh, Pa.; J. Aston, professor and head of department, and J. D. Beatty, secretary, mining and metallurgical advisory boards. Department of Mining Engineering, Lehigh University, Bethlehem, Pa.; Prof. H. Eckfeldt, head. Department of Mining Engineering, Lafayette College, Easton, Pa.; W. B. Plank, head. School of Mines, University of Pittsburgh, Pittsburgh, Pa.; E. A. Holbrook, dean. School of Mineral Industries, The Pennsylvania State College, State College, Pa.; E. Steidle, dean.

South Dakota—South Dakota State School of Mines, Rapid City, S. D.; C. C. O'Harra, president.

Texas—College of Mines and Metallurgy, University of Texas, El Paso, Tex.; C. A. Puckett, dean.

Utah—Schools of Mines and Engineering, University of Utah, Salt Lake City, Utah; R. B. Ketchum, dean.

Virginia—Department of Mining Engineering, Virginia Polytechnic Institute, Blacksburg, Va.; Prof. O. C. Burkhart, head. Corcoran and Rogers School of Geology, University of Virginia, Charlottesville, Va.; Wilbur A. Nelson, head.

Washington—College of Mines, University of Washington, Seattle, Wash.; Milnor Roberts, dean. School of Mines and Geology, State College of Washington, Pullman, Wash.; A. E. Drucker, dean.

West Virginia—School of Mines, West Virginia University, Morgantown, W. Va.; Prof. C. E. Lawall, director.

Wisconsin—Department of Mining and Metallurgy, University of Wisconsin, Madison, Wis.; Prof. R. S. McCaffery, chairman. Wisconsin Mining School, Platteville, Wis.; H. B. Morrow, director.

Wyoming—Department of Mining Engineering, University of Wyoming, Laramie, Wyo.; Prof. J. R. Guitéras, head.

Other Countries:

Argentine—Universidad de Buenos Aires, Buenos Aires; Universidad Nacional del Litoral, Rosario.

Australia—University of Sydney, Sydney, New South Wales; University of Melbourne, Melbourne, Victoria; University of Queensland, Brisbane, Queensland; University of Adelaide, Adelaide, South Australia; University of Western Australia, Perth, Western Australia; School of Mines, Ballarat, Victoria; University of Tasmania, Hobart, Tasmania.

Austria—Montanistische Hochschule, Leoben.

Bolivia—Escuela Nacional de Minas, Oruro.

Brazil—Escola Polytechnica de São Paulo, São Paulo; Escola Polytechnica do Rio Grande do Sul, Porto Alegre; Escola Polytechnica do Rio de Janeiro, Rio de Janeiro; Escola de Minas de Ouro Preto, Ouro Preto, Minas Geraes.

British Isles: ENGLAND—University of Birmingham, Birmingham; University of Cambridge, Cambridge; University of Leeds, Leeds; University of Liverpool, Liverpool; The Royal School of Mines, Imperial College, University of London, London; University of Manchester, Manchester; University of Nottingham, Nottingham; University of Sheffield, Sheffield; School of Metalliferous Mining, Camborne, Cornwall; Armstrong College, Newcastle-upon-Tyne.
WALES—University College of Wales, Aberystwyth; University College of South Wales and Monmouthshire, Cardiff; University College of Swansea, Swansea.
SCOTLAND—Heriot Watt College, University of Edinburgh, Edinburgh; Royal Technical College, University of Glasgow, Glasgow; Hamilton Technical School, Hamilton, Lanark; Coatbridge Technical School and Mining College, Coatbridge, Lanark; County Mining School, Falkirk; W. M. Ramsey Technical Institute, Edinburgh; Robert Gordon's Technical College, Aberdeen.
IRELAND—Queen's University, Belfast, Northern Ireland.

Bulgaria—Sofia University, Sofia; Tsar Boris State Technical School, Sofia.

Canada—Nova Scotia Technical College, Halifax, Nova Scotia; Dalhousie University, Halifax, Nova Scotia; Acadia University, Wolfville, Nova Scotia; University of St. Francis Xavier, Antigonish, Nova Scotia; University of New Brunswick, Fredericton, New Brunswick; Mount Allison University, Sackville, New Brunswick; University of Toronto, Toronto, Ontario; Queen's University, Kingston, Ontario; McGill University, Montreal, Quebec; University of Manitoba, Winnipeg, Manitoba; University of Saskatchewan, Saskatoon, Saskatchewan; University of Alberta, Edmonton, Alberta; University of British Columbia, Vancouver, British Columbia.

Chile—Escuela de Ingeniería, Universidad de Chile, Santiago; Catholic Universidad de Santiago, Santiago; Escuela de Minería, Copiapó; Escuela de Minería, La Serena; Escuela de Salitre de Antofagasta, Antofagasta.

China—Nankai University, Tientsin; North Western University, Peiping; Peiyang University, Tientsin; National Government University, Peiping.

Colombia—Universidad Nacional Bogota; Instituto Tecnico Central, Bogota; Universidad del Cauca, Popayan; Universidad de Narino, Pasto; Facultad Nacional de Minas, Medellin.

Cuba—University of Havana, Havana.

Czechoslovakia—College of Mining, Pribram, Bohemia; Czech Polytechnical School, Prague; German Polytechnical School, Prague; Czech Polytechnical School, Brno; German Polytechnical School, Brno.

Denmark—The University of Copenhagen, Copenhagen.

Ecuador—Central University of Quito, Quito.

Egypt—Egyptian University, Faculty of Sciences, Cairo.

Estonia—Tallinna Tehnikum, Tallinn; E. V. Tartu Ulikool, Tartu.

Finland—Abo Akademi (Abo Academy), Abo; Helsingin Yliopisto (The University of Helsinki), Helsinki.

France—Ecole Nationale Supérieure des Mines, Paris; Ecole Nationale Supérieure des Mines de Saint-Etienne, St. Etienne; Ecole Supérieure de Métallurgie et d'Industrie Minière de l'Université de Nancy, Nancy; Ecole Centrale des Arts et Manufactures, Paris; Ecole Polytechnique, Paris; Conservatoire National des Arts et Métiers, Paris; Ecole des Maitres Mineurs d'Alès, Alès; Ecole des Maitres Mineurs de Douali, Douai; Université de Paris, (Sorbonne), Paris; Université d'Aix, Marseille; Université de Besançon, Besançon; Université de Bordeaux, Bordeaux; Université de Caen, Caen; Université de Clermont-Ferrand, Clermont-Ferrand; Université de Grenoble, Grenoble; Université de Dijon, Dijon; Université de Lille, Lille; Université de Lyon, Lyon; Université de Montpellier, Montpellier; Université de Rennes, Rennes; Université de Toulouse, Toulouse; Université de Strasbourg, Strasbourg.

Germany—Bergakademie (Mining Academy), Freiberg, Saxony; Bergakademie, Clausthal, Harz; Technische Hochschulen (Technical High Schools) at Berlin, Aachen, Breslau.

Greece—University of Athens, Athens; University of Saloniki, Saloniki; Metsovian School of Arts, Athens.

India—Presidency College, Calcutta; Bengal Engineering College, Howrah; Suresh Chandra Inste-School of Mines, Ethora; College of Engineering, Poona; Prince of Wales College, Jammu; Benares Hindu University, Benares; Central College, Bangalore; Rangoon University, Rangoon.

Italy—Royal School of Engineering, Rome; Royal School of Engineering, Torino; Royal School of Engineering, Palermo.

Japan—Tokio Imperial University, Tokio; Kyoto Imperial University, Kyoto; Tohoku Imperial University, Sendai; Kyushu Imperial University, Fukuoka; Hockaido Imperial University, Sapporo; Ryojun Technological University, Ryojun, Port Arthur; Osaka Technological University, Osaka; Waseda University, Tokio; Akita Mining and Metallurgical College, Akita; Meiji Senmon College, Tobata; Kumamoto Higher Technological College, Kumamoto; Keijo Higher Technological College, Keijo, Seoul.

Latvia—Latvijas Universitate (University of Latvia), Riga; Valsts Technikums (State Technical School), Riga.

Mexico—Colegio de Estato, Guanajuato, Guanajuato; Escuela de Ingenieros, Mérida, Yucatan; Escuela de Ingenieros, Morelia, Michoacan; Escuela de Minería de Guadalajara, Guadalajara; Jalisco; Escuela de Mineria de Guanajuato, Guanajuato, Guanajuto; Escuela de Mineria de Mexico, Mexico, D. F.; Escuela de Minería de San Luis Potosi, San Luis Potosi, San Luis Potosi; Escuela Nacional de Maestros, Zacatecas, Zacatecas; Ingenieros Agrónimos, Leon, Guanajuato; Instituto Geológico, Mexico, D. F.; Instituto Juarez, Villahermosa, Tabasco; Universidad Nacional de Mexico, Mexico, D. F.

Netherlands—University of Amsterdam, Amsterdam; Technische Hoogschool, Delft; Rijksuniversiteit, Groningen; Rijksuniversiteit, Leiden; Rijksunversiteit, Utrecht; Roman Catholic University, Nijmegen.

New Zealand—University College, Auckland; Victoria University College, Wellington; Canterbury College, Christchurch; Otago University, Dunedin; The School of Mines, at Thames, Waihi, Huntly, Westport, and Reefton.

Norway—Mineralogical Institute of the University of Norway, Oslo; Institute of Technology of Norway, Nidaros.

Panama—National Institute, Panama City; La Salle College, Panama City.

Peru—Escuela de Ingenieros, Lima.

Poland—Akademja Górnicza w Krakpwie (Mining Academy in Krakow), Krakow; Politechnika Warszawska (Polytechnic Institute in Warsaw), Warsaw; Politechnika Lwowska (Polytechnic Institute in Lwów), Lwów.

Portugal—Instituto Superior Tecnico, Lisbon; Instituto Superior de Agronomia, Lisbon; Instituto Industrial de Lisboa, Lisbon; Faculdade de Sciencias da Universidade de Lisboa, Lisbon; Universidade do Porto, Oporto; Institudo Industrial e Comercial, Oporto; Faculdade de Sciencias do Universidade de Coimbra, Coimbra.

Siam—Chulalankarana University, Bangkok.

South Africa—University of the Witwatersrand, Johannesburg; University of Stellenbosch, Stellenbosch; University of Cape Town, Groote Schuur; Transvaal University College, Pretoria; Grey University College, Bloemfontein; Rhodes University College, Grahamstown; Natal University College, Maritzburg.

Spain—Escuela Especial de Ingenieros de Miñas, Madrid; Escuela de Ingenieros Industriales, Barcelona; Instituto Geológico y Minero de España, Madrid; Escuela Central de Ingenieros Industriales, Madrid; Escuela Industrial, Madrid; Universidad de Barcelona, Barcelona; Universidad de Granada, Granada; Universidad de Oviedo, Oviedo; Universidad de Salamanca, Salamanca; Universidad de Santiago, Santiago; Universidad de Sevilla, Sevilla; Universidad de Valencia, Valencia; Universidad de Zaragoza, Zaragoza.

Sweden—University of Upsala, Upsala; University of Lund, Lund; Stockholm University, Stockholm; School of Mining, The Royal Institute of Technology, Stockholm; Chalmers Technological Institute, Gothenburg.

Switzerland—University of Basel, Basel; University of Berne, Berne; University of Fribourg, Fribourg; University of Geneva, Geneva; University of Lausanne, Lausanne; University of Neuchatel, Neuchatel; University of Zurich, Zurich; Federal Institute of Technology, Zurich.

Turkey—Ecole des Ingénieure, Gumush-Suyu, Constantinople; Ecole des Mines de Zongouldak, Zongouldak.

Union of Socialist Soviet Republics—Leningrad Mining Institute, Leningrad; Dniepropetrovsk Mining Institute, Dniepropetrovsk; Moscow Mining Academy, Moscow.

Uruguay—Facultad de Ingeniería, Universidad de Montevideo, Montevideo.

Venezuela—Universidad de Caracas, Caracas; Universidad de Mérida, Mérida.

Yugoslavia—Visoka Rudarska Skola Ljubljanskog (School of Mines of Ljubljana University), Ljubljana; Srednja Rudarska Skola (Trade School of Mines), Celje, Sloenija.

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Government Departments and Bureaus

U. S. Bureau of Mines:

Washington, D. C.—Scott Turner, Director; Joseph H. Hedges, assistant to the director.

Technologic Branch—Ozni P. Hood, chief and chief engineer mechanical division; Harry C. Fowler, acting chief engineer, petroleum and natural gas division; Roscoe A. Catteil, chief engineer, helium division; Charles W. Wright, chief engineer, mining divison; Arno C. Fieldner, chief engineer, experiment stations division; Reginald S. Dean, chief engineer, metallurgical division; Charles E. Munroe, chief engineer, explosives division.

Field Stations—Harry F. Yancey, acting supervising engineer, Seattle, Wash.; Henry H. Storch, supervising engineer, New Brunswick, N. J.; Will H. Coghill, supervising engineer, Rolla, Mo.; Clifford W. Seibel, supervising engineer, Amarillo, Tex.; Eugene D. Gardner, supervising engineer, Tucson, Ariz.; Thomas L. Joseph, supervising engineer, Minneapolis, Minn.; Bennie W. Gandrud, acting supervising engineer, Tuscaloosa, Ala.; Edmund S. Leaver, supervising engineer, Reno, Nev.; Dorsey A. Lyon, supervising engineer, Salt Lake City, Utah; Charles G. Maier, supervising engineer, Berkeley, Calif.; Nicholas A. C. Smith, supervising engineer, Bartlesville, Okla.; George St. J. Perrott, supervising engineer, Pittsburgh, Pa., station.

Field Offices—Clifford P. Bowie, supervising engineer, San Francisco, Calif.; George E. McElroy, supervising engineer, Moscow, Idaho; Harry B. Hill, supervising engineer, Dallas, Tex.; Joseph W. Horne, supervising engineer, Boulder, Colo.; Harold P. Rue, supervising engineer, Laramie, Wyo.; Everett P. Hayes, supervising engineer, Carlsbad, N. M.; Benjamin D. Stewart, supervising engineer, in charge of Alaskan work (by courtesy of Gelogical Survey, Department of the Interior).

Economics Branch—Charles P. White, chief and head of coal division; William W. Adams, acting chief statistician, mineral statistics division; Paul M. Tyler, chief engineer, rare metals and non-metals division; Edward B. Swanson, chief economist, petroleum economics division; Carl E. Julihn, chief engineer, common metals division.

Field Offices—John P. Dunlop, supervising statistician, Joplin, Mo.; Clarence N. Gerry, supervising statistician, Salt Lake City, Utah; Charles W. Henderson, supervising engineer, Denver, Colo.; Victor C. Heikes, supervising engineer, San Francisco, Calif.

Health and Safety Branch—R. R. Sayers, chief and chief surgeon, health division; Daniel Harrington, chief engineer, safety division.

Field Offices—Frank E. Cash, engineer-in-charge, Birmingham, Ala.; Edward H. Denny, engineer-in-charge, Denver, Colo.; John J. V. Forbes, supervising engineer, instruction section, Pittsburgh, Pa.; Frank S. Crawford, engineer-in-charge, Duluth, Minn.; Charles A. Herbert, supervising engineer, Vincennes, Ind.; Dorsey J. Parker, supervising engineer, Salt Lake City, Utah; Frank V. Meriwether, passed assistant surgeon, Picher, Okla.; Arthur L. Murray, acting assistant surgeon, Salt Lake City, Utah; Simon H. Ash, engineer-in-charge, Berkeley, Calif.

Administrative Branch—Joseph H. Hedges, chief; John A. Davis, chief engineer, information division; John D. Secrest, chief clerk and head, office administration division; office of chief mining engineer—George S. Rice, engineer.

U. S. Geological Survey:

Acting Director, W. C. Mendenhall; Administrative Geologist, J. D. Sears; Chief Clerk, J. J. Madigan; Geologic Branch, W. C. Mendenhall; Alaskan Branch, P. S. Smith; Topographic Branch, J. G. Staack; Water-Resources Branch, N. C. Grover; Conservation Branch, Herman Stabler; Editor, B. H. Lane.

Other Countries:

Argentine—Dirección General de Minas Geologia é Hidrologia, Buenos Aires.

Australia—The Geological Survey, Sydney, New South Wales; Department of Mines, Sydney, New South Wales; Department of Mines, Melbourne, Victoria; Department of Mines, Brisbane, Queensland; Department of Mines, Perth, Western Australia; Department of Mines, Adelaide, South Australia; Department of Mines, Hobart, Tasmania.

Austria—Bundesministerium fuer Handel und Verkehr, Oberste Bergbehoerde, Wien.

Bolivia—Dirección General de Minas y Planos Mineros, La Paz.

Brazil—Serviço Geologico e Mineralogico, Ministerio da Agricultura, Rio de Janeiro; Serviço Geologico do Estado de São Paulo São Paulo; Serviço Geologico do Estado de Minas Geraes, Bello Horizonte, Minas Geraes.

Bulgaria—Ministry of Commerce, Industry, and Labor, Sofia.

Canada—Department of Mines, Ottawa, Ontario; Department of Public Works and Mines, Halifax, Nova Scotia; Department of Lands and Mines, Fredericton, New Brunswick; Department of Mines, Toronto, Ontario; Bureau of Mines, Quebec, Quebec; Department of Mines and Natural Resources, Winnipeg, Manitoba; Bureau of Labour and Industries, Regina, Saskatchewan; Mines Branch, Edmonton, Alberta; Scientific and Industrial Research Council, Edmonton, Alberta; Department of Mines, Victoria, British Columbia.

Chile—Superintendencia de Salitre y Minas, Santiago.

China—Ministry of Agriculture and Mining, Nanking; Government Geological Bureau, Nanking.

Colombia—Ministerio de Industrias, Sección Tecnica de Minas y Petroleo, Bogota.

Cuba—Bureau of Forests and Mines, Department of Agriculture, Commerce and Labor, Havana.

Czechoslovakia—Ministry of Public Works, Prague.

Denmark—Danmarks Geologiske Undersögelse (Geological Survey of Denmark), Copenhagen; Geologiske og Geografiske Undersögelser i Gronland (Geological and Geographical Survey of Greenland), Copenhagen.

Egypt—Department of Mines and Quarries, Cairo; Geological Department, Cairo.

Estonia—Maeosakond, Majanduseministeerium, Tallinn.

Finland—Geologinen Toimisto (The Geological Commission), Helsinki.

France—Direction des Mines, Ministère des Travaux Publics, 244 Boulevard Saint-Germain, Paris; Service de la Carte Geologique Détaillée de la France, Ministère des Travaux Publics, 62 Boulevard Saint-Michel, Paris.

Germany—Prussian Ministry of Commerce and Industry, Mining Section, Berlin; Geological State Survey, Berlin.

Great Britain—The Mines Department, Dean Stanley St., London, S.W. 1; Geological Survey of Great Britain, 28 Jermyn St., London, S.W. 1.

Greece—Bureau of Mines, Ministry of National Economy, Athens.

Guatemala—Dirección General de Minería, Guatemala.

Honduras—Sección de Tierras y Minería, Ministero de Fomento, Tegucigalpa.

India—Geological Survey of India, Calcutta; Chief Inspector of Mines in India, Dhanbad.

Italy—Corpo Reale della Miniere (Royal Mining Bureau), Rome; Reale Ufficio Geologico (Royal Geological Bureau), Rome.

Japan—Mining Bureau, Department of Commerce and Industry, Tokio; Geological Survey of Japan, Department of Commerce and Industry, Tokio.

Mexico—Departamento de Minas, Secretaria de Industria, Comercio y Trabajo, Mexico, D. F.

Netherlands—Sectie Mijnwegen, Department van Waterstaat, The Hague; Rijks Geologische Dienst, Department van Waterstaat, Haarlem.

New Zealand—The Mines Department, Wellington; The Geological Survey Branch of the Department of Scientific and Industrial Research, 156 The Terrace, Wellington.

Norway—Norges Geologiske Undersökelse (Geological Survey of Norway), Oslo; Statens Raastoffkomité (Government Bureau of Natural Resources), Oslo.

Panama—Department of Agriculture and Public Works, Panama.

Peru—Dirección de Minas y Petroleo, Ministerio de Fomento, Lima.

Poland—Ministerstwo Przemyslu i Handlu (Ministry of Commerce and Industry), Department II Górniczo-Hutniczy (Department of Mining and Metallurgy), Warsaw.

Portugal—Direcção Geral de Minas a Serviços Geologicos, Ministerio do Comercio, Lisbon.

Siam—Royal Department of Mines and Geology, Bangkok.

South Africa—Department of Mines and Industries, Pretoria.

Spain—Dirección General de Minas y Combustibles (Bureau of Mines and Fuels), Ministerio de Fomento, Madrid.

Sweden—Geological Survey of Sweden, Department of Agriculture, Stockholm; Kungl. Kommerskollegium, Bergsbyran (Royal Board of Trade, Mines Branch), Department of Commerce, Stockholm.

Switzerland—Department des Innern, Bern.

Turkey—Direction Générale des Mines, Ministère de l'Economie, Angora.

Union of Socialist Soviet Republics—Directory of the Mining Industry, Chief Mining and Fuel Administration of the Supreme Economic Council, Moscow; The State Geological Survey, Leningrad.

Uruguay—Inspección de Minas é Industrias, Montevideo.

Yugoslavia—Drzavni Geoloski Zavod (Chief Geological Section), Generalna Rudarska Direkcija (General Mining Bureau), Sarajevo, Bosnia.

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Trade Associations

United States:

General—American Bureau of Metal Statistics, 33 Rector St., New York; American Mining Congress, 841 Munsey Building, Washington, D. C.; California Metal and Mineral Producers' Association, San Francisco; Chamber of Commerce and Mines, Douglas, Ariz.; California Oil and Gas Association, Los Angeles, Calif.; Nevada Mine Operators' Association, Reno, Nev.; Northwest Mining Association, Spokane, Wash.

Copper—Copper and Brass Research Association, 25 Broadway, New York; Copper Exporters, Inc., and The Copper Institute, 25 Broadway, New York.

Feldspar—Feldspar Grinders' Institute, Inc., 7 East 44th St., New York.

Gypsum—Gypsum Association, 211 W. Wacker Drive, Chicago, Ill.

Iron and Steel—American Iron and Steel Institute, 506 Evening Post Building, 75 West St., New York; Association of American Steel Manufacturers, Pittsburgh, Pa.; Lake Superior Iron Ore Association, Cleveland, Ohio.

Lead—Lead Industries Association, 420 Lexington Ave., New York.

Limestone, Lime—The National Agricultural Limestone Products Association, Hartman Building, Columbus, Ohio; National Lime Association, 927 Fifteenth St., N.W., Washington, D. C.

Manganese—American Manganese Producers' Association, Metropolitan Bank Building, Washington, D. C.

Petroleum—American Petroleum Institute, 250 Park Ave., New York.

Phosphate Rock—Phosphate Export Association, 420 Lexington Ave., New York.

Portland Cement—Portland Cement Association, 347 Madison Ave., New York.

Refractories—American Refractories Institute, 2218 Oliver Building, Pittsburgh, Pa.

Sand and Gravel—National Sand and Gravel Association, Suite 545 Munsey Building, Washington, D. C.

Silver—American Silver Producers' Association, Kearns Building, Salt Lake City, Utah.

Slate—National Slate Association, 644 Drexel Building, Philadelphia, Pa.

Stone—National Crushed Stone Association, Merchandise Building, Washington, D. C.

Tin—American Tin Trade Association, 82 Wall St., New York.

Zinc—American Zinc Institute, 60 East 42nd St., New York.

Other Countries:

Australia—Australian Mines & Metals Association, Melbourne Victoria; Zinc Producers' Association, Melbourne, Victoria.

Bolivia—Asociación de Industriales Mineros, La Paz; Asociación de Industriales Mineros, Oruro.

Brazil—Associação do Industriaes Metallurgicos, São Paulo.

Canada—Ontario Mining Association, Northern Ontario Building, Toronto, Ontario; Northwest Ontario Chamber of Mines, 19 Francis Block, Fort William, Ontario; Manitoba Chamber of Mines, 203 Montreal Trust Building, Winnipeg, Manitoba; Industrial Development Board of Manitoba, Winnipeg, Manitoba; British Columbia Chamber of Mines, 402 West Pender St., Vancouver, British Columbia; Mining Association of British Columbia, 718 Granville St., Vancouver, British Columbia; Mining Association of Interior of British Columbia, Nelson, British Columbia.

Chile—Sociedad Nacional de Mineria, Santiago.

Czechoslovakia—The Czechoslovak Metallurgical Association, Prague; The Czechoslovak Mine Owners' Association, Prague.

France—Groupement 9 de la Conféderation Générale de la Production Française, Industries Minières, 35 rue Saint-Dominique, Paris; Union des Industries Métallurgiques & Minières, 7 rue de Madrid, Paris; Chambre Syndicale du Commerce des Métaux, 163 rue St. Honoré, Paris.

Germany—Fachgruppe Bergbau des Reichsverbandes der Deutschen Industrie (Mining Section of the State Association of German Industries), Berlin; Metallhuettenverband (Smelter Association), Berlin.

Great Britain—London Metal Merchants Association, London; Mineral Owners' Association of Great Britain, London; British Metal Trades Federation, Sheffield; British Lead & Zinc Mine Owners' Association, London; Federated Quarry Owners of Great Britain, Halifax; British Zinc Smelters' Conference, London.

India—The Indian Mining Association, Calcutta.

Italy—Federazione Nazionale Fascista dell' Industria Mineraria (National Fascist Federation of Mining Industries), Milano; Federazione Nazionale Fascista, dell' Industria Meccanica e Metallurgica (National Fascist Federation of Mechanical and Metallurgical Industries), Milano.

Japan—Nihon Kogyo Kai (Society of the Japanese Mining Industry), Tokio; Kozan Konwa Kai (Japanese Mining Association), Tokio; Suiyo Kai (Copper Trade Association), Tokio.

Norway—Bergverkernes Landssammenslutning (Mining Association), Oslo; Graniteksportörernes Forening (Granite Exporters Association), Halden; Ostlandske Steninduströforening (Association of Eastern Quarry Operators), Oslo.

Poland—Polski Zwiazek Przemyslowców Metalowych (Association of Polish Metallurgical Industries), Warsaw; Górnoslaski Zw. Przemyslowców Górniczo-Hutniczych (Union of Upper Silesian Industrialists of Mines and Foundries), Katawice, Upper Silesia.

Portugal—Associação Industrial Portuguesa, Lisbon.

South Africa—Transvaal Chamber of Mines, Johannesburg.

Spain—Asociación Patronal de Mineros, Madrid.

Sweden—Jernkontoret (Ironmasters' Association), Stockholm; Sveriges Industriförbund (Association of Industries of Sweden), Stockholm.

Turkey—Turk Maadenjilar Birgligi (Mining Association of Turkey), Galata, Constantinople.

Union of Socialist Soviet Republics—All-Union Syndicate of the Non-Ferrous Metal Industry, Moscow.

Note: In the foregoing directory, material for the United States was obtained direct from the respective agencies concerned. Material for the other countries was received from the American Consular Service; U. S. Bureau of Foreign and Domestic Commerce; and consuls general, trade commissioners, and commercial attachés representing the various countries.

Mining Dividends Paid in 1929 and 1930

Compiled by *Engineering and Mining Journal*

Official data supplied by individual companies except when indicated by an asterisk (*) in which case it is from published reports

Company, Metals Mined, and Class of Stock	Situation	Shares Outstanding	Par Value	1929 Per Share	1929 Total	1930 Per Share	1930 Total	Total Paid to End of 1930	Latest Dividend Paid to Dec 31, 1930 Date		Per Share
Mines in the United States											
American Metal, common	Various	868,185	No	$3.00	$2,382,907	$2.125	$1,844,861	$43,963,632	Dec.,	1930	$0.25
American Metal, pfd	Various	68,441	$100	6.00	450,552	6.00	410,622		Dec.,	1930	1.50
American Smelting & Refining, com.	Various	1,829,940	No	4.00	7,319,760	4.00	7,319,760		Nov.,	1930	1.00
American Smelting, 7% pfd.	Various	500,000	100	7.00	3,500,000	7.00	3,500,000	190,593,082	Dec.,	1930	1.75
American Smelting, 6% pfd.	Various	200,000	100	.....	.....	3.06575	608,337		Dec.,	1930	1.50
*American Zinc, Lead & Sm., pfd	Tenn., Mo.	80,328	25	3.00	240,984	6.00	481,868	.....	Oct.,	1930	6.00
*Amethyst Leasing	Colorado	8	400	7,000	56,000	.....	.....	56,000	June,	1929	800.00
Arizona Commercial	Arizona	265,000	5	0.50	133,500	0.25	65,250	2,544,000	Jan.,	1930	0.25
*Anaconda Copper	Various	8,865,033	50	6.75	43,550,297	5.00	44,325,165	309,833,660	Nov.,	1930	0.625
Bunker Hill & Sullivan	Idaho	327,000	10	9.00	2,943,000	6.25	2,043,750	47,891,243	Dec.,	1930	0.50
Bunker Hill, pfd.	Idaho	7,957	100	9.00	66,042	8.25	65,940		Dec.,	1930	0.75
Butte Copper & Zinc	Montana	600,000	5	0.50	30,000	.....	.....	.....	Dec.,	1929	0.50
Butte & Superior	Montana	290,197	10	2.00	580,395	.....	.....	20,277,351	Dec.,	1929	0.50
Calumet & Arizona	Ariz., N. M.	842,857	20	9.00	7,285,563	2.00	1,685,314	73,803,446	June,	1930	0.50
Calumet & Hecla	Michigan	2,005,502	25	4.50	9,024,759	1.50	3,008,253	29,079,779	June,	1930	0.50
Champion Copper	Michigan	100,000	25	10.00	1,000,000	.....	.....	32,170,261	Dec.	1929	4.00
Consolidated Lead & Zinc	Okla., Kan.	250,000	No	0.875	218,750	.....	.....	773,750	Dec.,	1929	0.125
Copper Range	Michigan	394,755	25	2.00	789,510	1.25	493,444	31,043,865	July,	1930	0 25
Dayrock Mining	Idaho	1,755,800	0.10	0.12	203,136	0.03	50,829	253,965	Mar.,	1930	0.03
Eagle-Picher Lead	Okla., Ariz.	1,000,000	20	0.60	600,000	0.40	400,000	.....	April,	1930	0.20
Eagle-Picher Lead, pfd.	Okla., Ariz.	5,928	100	6.00	50,910	6.00	44,644	.....	Oct.,	1930	1.50
Eureka Standard	Utah	1,499,590	0.10	.....	.....	0.06	89,975	89,975	Dec.,	1930	0.03
*Freeport Texas	Texas	729,884	No	4.00	2,919,376	5.00	3,649,420	.....	Oct.,	1930	1.00
Hecla Mining	Idaho	1,000,000	0.25	0.90	900,000	1.00	1,000,000	19,705,000	Dec.,	1930	0.25
Homestake Mining	South Dak.	251,160	100	7.00	1,758,120	8.00	2,009,280	57,366,364	Dec.,	1930	0.50
Inspiration Consolidated	Arizona	1,181,967	20	3.75	4,432,376	2.50	2,954,917	53,167,305	July,	1930	0.50
Isle Royale Copper	Michigan	150,000	25	2.00	300,000	0.50	75,000	3,487,500	Mar.,	1930	0.50
Kennecott Copper	Various	9,392,870	No	5.50	41,332,395	3.75	35,205,808	229,132,291	Oct.,	1930	0.50
Magma Copper	Arizona	408,155	No	4.75	1,938,736	4.25	1,734,659	9,663,023	Oct.,	1930	0.75
Miami Copper	Arizona	747,116	5	3.50	2,614,906	2.375	1,774,400	37,332,623	Aug.,	1930	0.375
*Mohawk Mining	Michigan	115,000	25	8.00	920,000	4.00	460,000	14,070,000	Nov.,	1930	0.25
Mother Lode Coalition	Alaska	2,500,000	No	0.40	1,000,000	0.10	250,000	14,000,000	June,	1930	0.10
National Lead	Various	309,831	100	5.00	1,549,155	8.00	2,478,648		Dec.,	1930	1.25
National Lead, pfd., A	Various	243,676	100	7.00	1,705,732	7.00	1,705,732	89,857,661	Dec.,	1930	1.75
National Lead, pfd., B	Various	103,277	100	6.00	619,662	6.00	619,662		Nov.,	1930	1.50
*Nevada Consolidated	Various	4,855,109	No	3.00	14,565,327	1.625	7,889,552	91,530,738	Nov.,	1930	0.25
New Jersey Zinc	Various	1,963,264	25	4.00	7,853,056	3.00	5,889,792	.....	Dec.,	1930	0.50
Newmont Mining	California	530,646	10	4.00	1,989,980	4.00	2,095,362	8,996,622a	Oct.,	1930	1.00
*New Quincy	Utah	1,400,000	0.10	0.20	280,000	.....	.....	280,000	Sept.,	1929	0.10
North Lily	Utah	895,550	0.10	1.00	795,550	0.15	119,332	1,073,992	Jan.,	1930	0.15
Park Utah Consolidated	Utah	2,093,500	1.00	0.60	1,256,100	.....	.....	37,732,862	July,	1929	0.20
Phelps Dodge	Various	2,822,541	25	2.75	5,500,000	3.00	6,000,000	.....	Oct.,	1930	0.75
St. Joseph Lead	Various	1,950,462	10	3.00	5,851,375	3.00	5,851,387	.....	Dec.,	1930	0.75
St. Mary's Mineral Land	Michigan	160,000	25	5.00	800,000	3.00	480,000	.....	July,	1930	1.00
Sherman Lead	Idaho	3,675,000	0.25	.....	.....	0.01	36,750	36,750	Mar.,	1930	0.01
Sidney Leasing	Idaho	7,215	1.00	3.00	21,645	.....	.....	72,150	Sept.,	1929	1.00
*Sidney Mining	Idaho	1,500,000	1.00	0.02	30,000	.....	.....	86,250	Oct.,	1929	0.01
Silver King Coalition	Utah	1,220,467	5.00	1.20	1,464,560	0.80	976,374	29,007,072	Oct.,	1929	0.15
Sunshine Mining	Idaho	1,488,822	0.10	0.22	327,541	0.16	238,212	863,517	Dec.,	1930	0.03
Tennessee Corporation	Tennessee	857,761	No	1.00	847,730	1.00	857,680	.....	Dec.,	1930	0.25
Texas Gulf Sulphur	Texas	2,540,000	No	4.00	10,160,000	4.00	10,160,000	66,357,500	Dec.,	1930	1.00
Tintic Standard	Utah	1,153,315	1.00	1.30	1,499,329	1.10	1,268,647	13,825,231	Dec.,	1930	0.20
Tonopah Mining	Nevada	1,000,000	1.00	0.15	150,000	.....	.....	16,875,000	Oct.,	1929	0.075
U.S. Smelting, Ref. & Min., com.	Utah, Colo	620,562	50	3.50	1,848,701	2.25	1,396,264	64,943,975	Oct.,	1930	0.25
U. S. Smelting, pfd.	Calif., Ariz.	486,350	50	3.50	1,702,225	3.50	1,702,225		Oct.,	1930	0.875
United Verde Extension	Arizona	1,050,000	0.50	3.75	3,937,500	3.00	3,150,000	39,742,500	Nov.,	1930	0.50
Utah-Apex	Utah	528,200	5	0.50	264,100	.....	.....	3,499,325	Nov.,	1929	0.25
*Utah Copper	Utah	1,624,490	10	20.00	32,489,800	10.00	16,244,900	218,715,997	Dec.,	1930	2.00
*Vanadium Corporation	Va., Peru	376,638	No	3.00	1,129,906	3.00	1,129,906	.....	Nov	1930	0 75
Mines in Canada											
Consolidated M & S	Brit. Col.	536,134	$25	$12.50	$6,370,0[illegible]	$12.50	$6,327,744	$38,978,352	July,	1930	$6.25
Dome Mines	Ontario	953,334	No	1.00	953,334	1.00	953,334	14,789,176	Oct.,	1930	0.25
Granby Consolidated	Brit. Col	450,000	100	7.00	3,150,000	5.25	2,362,500	.....	Nov.,	1930	0.50
Hollinger	Ontario	4,920,000	5	0.65	3,198,000	0.70	3,444,000	54,786,400	Dec.,	1930	0.10
*Howe Sound	B. C., Mexico	496,038	No	4.50	2,232,171	4.50	2,232,171	11,706,495	Oct.,	1930	1.00
*International Nickel, common	Ontario	14,584,025	No	0.90	12,382,387	1.00	14,584,025	.....	Dec.,	1930	0.25
*International Nickel, pfd.	Ontario	89,125	100	7.00	623,875	7.00	623,875	.....	Nov.,	1930	1.75
*International Nickel, pfd.	Ontario	3,750,000	5	0.35	1,312,500	0.35	1,312,500	.....	Nov.,	1930	0.0875
Lake Shore	Ontario	2,000,000	1	1.10	2,200,000	1.50	3,000,000	11,220,000	Dec.,	1930	0.30
McIntyre Porcupine	Ontario	798,000	5	1.00	798,000	1.00	798,000	9,197,408	Dec.,	1930	0.25
Mining Corporation	Ontario	1,660,050	5	0.25	415,012	.....	.....	6,225,187	Dec.,	1929	0.125
Nipissing Mines	Ontario	1,200,000	5	0.30	360,000	0.30	360,000	29,760,000	Oct	1930	0.075
Noranda Mines	Quebec	2,239,772	No	.....	.....	2.50	5,599,430	5,599,430	Oct.,	1930	0.50
Premier Gold	Brit. Col	5,000,000	1	0.24	1,200,000	0.24	1,200,000	14,750,000	Oct.,	1930	0.06
Sylvanite Gold	Ontario	3,299,500	1	.....	.....	0.02	65,990	65,990	Dec.,	1930	0.02
Teck-Hughes Gold	Ontario	4,787,000	1	0.60	2,860 286	0 60	2,872,200	9,781,058	Oct.,	1930	0.60
Mines in Mexico											
Amparo Mining	Jalisco	2,000,000	$1	$0.04	$80,000	.....	.....	$5,352,177	Nov.,	1929	$0.01
Boleo Mining, common	Lower Calif.	720,000	100fr.	17.82fr.	12,830,400fr.	20fr.	14,400,000fr.(b)	.....	.....		.....
Boleo, founders'	Lower Calif.	46,000	No	30.39fr.	1,397,940fr.	56.10fr.	2,580,600fr.(b)	.....	.....		.....
*El Oro Mining	Zacatecas	1,147,500	5s	1s	£52,375	10d	£43,646	.....	Nov.,	1930	10d
*Fresnillo Company	Zacatecas	1,000,000	No	$0.50	$500,000	$0.25	$250,000	.$750,000	Feb.,	1930	$0.25
*Greene Cananea	Sonora	500,000	$100	7.50	3,750,000	4.75	2,375,000	.....	July,	1930	0.75
Lucky Tiger	Sonora	715,337	10	0.425	304,018	0.225	160,951	13,635,778	Dec.,	1930	0.10
*Mexican Corp	Puebla, Zac.	1,000,000	10s	1s	£50,000	.....	.....	£50,000	Nov.,	1929	1s
*San Francisco Mines	Chihuahua	1,600,000	10s	3s 9d	£300,000	2s 3d	£175,000	.....	Jan.,	1930	2s 3d
*Santa Gertrudis	Hidalgo	1,800,000	£1	3s	£270,000	3s	£270,000	.....	July,	1930	1s 6d

Note—For U. S. Smelting, Refining & Mining, American Smelting & Refining, American Metal, and Phelps Dodge see U. S. table. For Howe Sound, see Canada table. All these properties operate Mexican mines.

Mining Dividends Paid in 1929 and 1930—Continued

Company, Metals Mined, and Class of Stock	Situation	Shares Outstanding	Par Value	1929 Per Share	1929 Total	1930 Per Share	1930 Total	Total Paid to End of 1930	Latest Dividend Paid to Dec. 31, 1930 Date	Per Share
Mines in Central and South America										
*Andes Copper	Chile	3,582,379	No	$2.25	$8,049,364	$2.125	$7,612,555	$17,982,271	Nov., 1930	0.25
Cerro de Pasco	Peru	1,122,842	No	5.75	6,456,341	5.50	6,175,631	.....	Nov., 1930	1.00
*Chile Copper	Chile	4,415,497	$25	4.125	18,213,905	2.75	12,142,621	96,813,615	Dec., 1930	0.50
*Disputada Mining	Chile	600,000	25 pe	4 pe	2,400,000 pe	.....	.....	.....	.....	.....
N. Y. & Honduras Rosario	Honduras	200,000	$10	$2.50	$550,000	$1.875	$375,000	$9,075,000	Dec., 1930	0.50
*Oploca	Bolivia	600,000	£1	6s	£180,000	.....	.....	.....	.....	.....
Oruro	Bolivia	300,000	20 pe	2.50 pe	750,000 pe	.....	.....	21,600,000 pe	May, 1929	2.50pe
*Patino	Bolivia	1,045,100	$20	16s	£836,080	.....	.....	.....	Dec., 1929	4s
*Poderosa Mining	Chile	290,000	£1	1s	11,600	1s	£11,600	.....	Jan., 1930	1s
St. John del Rey, common	Brazil	546,265	£1	2s	54,626	2s 3d	61,454	.....	Nov., 1930	9d
St. John del Rey, pfd	Brazil	100,000	£1	2s	10,000	2s	10,000	.....	Nov., 1930	1s
Tocopilla Mining	Chile	400,000	£1	7s 3d	142,500	2s	40,000	.....	.....	.....
Mines in Europe										
Esperanza Copper	Spain	300,000	£1	1s 4.8d	£17,500	1s 4.8d	£19,031	£262,781	June, 1930	1s 4.8d
Rio Tinto, common	Spain	425,000	£5	50s	1,062,500	40s	850,000	.....	Nov., 1930	10s
Rio Tinto, pfd	Spain	325,000	£5	5s	81,250	5s	81,250	.....	Nov., 1930	2s 6d
Tharsis Sulphur	Spain	625,000	£2	4s	125,000	5s	156,250	11,819,760	May, 1930	5s
Vieille Montagne, "A"	Various	200,000	80 fr	200 fr	40,000,000 fr	150 fr	30,000,000 fr	.....	Nov., 1930	75 fr
Vieille Montagne, "B"	Various	10,000	800 fr	50 fr	500,000 fr	37.50 fr	375,000 fr	.....	Nov., 1930	18.75 fr
Mines in Africa										
Anglo-American	Various	4,000,000	10s	2s 9d	£464,807	2s 6d	£450,000	.....	Mar., 1930	2s 3d
Ashanti Goldfields	Gold Coast	1,250,000	4s	2s 2.4d	137,500	3s	187,500	£2,965,981	July, 1930	1s 4.8d
Brakpan Mines	Transvaal	1,020,000	£1	9s 9d	497,250	8s 9d	446,250	.....	Dec., 1930	4s 6d
Con. African Selection	Gold Coast	999,111	5s	3s 6d	174,844	3s	149,866	786,798	Aug., 1930	1s 9d
*Con. Main Reef	Transvaal	1,247,602	£1	2s	121,234	2s	121,234	2,278,935	Dec., 1930	1s 3d
*Crown Mines	Transvaal	1,880,212	10s	6s 3d	576,914	6s 9d	634,571	15,587,216	Dec., 1930	3s 6d
*DeBeers Cons., common	Cape Colony	1,090,514	£2 10s	15s	817,885	.....	.....	.....	Dec., 1929	5s
*De Beers Cons., pfd	Cape Colony	800,000	£2 10s	£1	800,000	£1	800,000	.....	Dec., 1930	10s
*Durban Roodeport	Transvaal	750,000	10s	.....	.....	9d	28,125	.....	Dec., 1930	6d
*Geduld Proprietary	Transvaal	1,460,857	£1	6s 3d	414,516	6s 6d	474,779	.....	Dec., 1930	3s 3d
*Geldenhuis Deep	Transvaal	585,753	£1	1s	28,222	1s 9d	51,253	£2,960,384	Dec., 1930	1s
*Government Gold Areas	Transvaal	5,600,000	5s	4s 6d	1,260,000	4s 6d	1,260,000	.....	Dec., 1930	2s 3d
*Johannesburg Cons	Various	3,950,000	£1	3s	592,500	1s 6d	296,250	.....	June, 1930	1s 6d
*Langlaagte Estate	Transvaal	1,519,833	£1	3s	227,975	4s	303.967	.....	Dec., 1930	2s
London Tin	Nigeria	2,200,250	10s	8s	176,000	4s	88,000c	371,541	Jan., 1930	4s
London Tin, pfd	Nigeria	2,611,550	10s	.....	.....	2½d	19,541		April, 1930	2½d
Lydenburg Platinum	Transvaal	1,460,000	4s	6d	36,500	.....	.....	36,500	Dec., 1929	3d
*Messina Development	Transvaal	1,000,000	5s	1s 10½d	93,750	1s 9d	87,500	494,290	July, 1930	9d
*Modderfontein B	Transvaal	2,800,000	5s	4s	560,000	4s	560,000	10,097,500	Dec., 1930	2s
*Modderfontein Deep	Transvaal	2,000,000	5s	6s 9d	675,000	6s 6d	650,000	.....	Dec., 1930	3s 3d
*Modderfontein East	Transvaal	930,805	£1	4s	185,776	4s	185,776	489,497	Dec., 1930	2s
New Jagersfontein	Orange Free State	850,000	£1	2s	85,000	.....	.....	8,467,049	Sept., 1930	2s
*New Modderfontein	Transvaal	2,800,000	10s	14s	1,960,000	13s 3d	1,855,000	21,748,000	Dec., 1930	6s 6d
*New State Area	Transvaal	1,514,037	£1	2s 6d	189,254	3s 6d	264,956	.....	Dec., 1930	2s
*Nourse Mines	Transvaal	827,821	£1	6d	19,592	1s 3d	48,979	2,358,257	Dec., 1930	9d
*Robinson Deep, "A"	Transvaal	500,000	1s	3s	75,000	3s	75,000	.....	Dec., 1930	1s 6d
*Robinson Deep, "B"	Transvaal	881,807	£1	.....	.....	7½d	27,556	.....	Dec., 1930	7½d
*Rose Deep	Transvaal	700,000	£1	.....	.....	1s	35,000	4,535,687	Dec., 1930	6d
*Simmer & Jack	Transvaal	5,000,000	2s 6d	.....	.....	1½d	32,500	.....	Dec., 1930	1½d
Spring Mines	Transvaal	1,500,000	£1	7s	£525,000	7s 3d	543,750	.....	Aug., 1930	3s 6d
*Sub Nigel	Transvaal	1,500,000	10s	4s	300,000	5s	375,000	.....	Dec., 1930	5s
Tanganyika Concessions, common	Various	5,473,606	£1	1s 6d	410,520	6d	136,840	2,364,674	Aug., 1930	6d
Tanganyika Concessions, pfd	Various	26,394	£1	2s	2,639	2s	2,639			
*Taquah & Abosso	Gold Coast	933,230	5s	.....	.....	3d	11,665	11,665	Dec., 1930	3d
*Union Miniere, capital sh	Belgian Congo	264,000	100 fc	300 fc	79,200,000 fc	300 fc	79,200,000 fc	.....	July, 1930	300 fc
*Union Miniere, dividend sh	Belgian Congo	264,000	No	300 fc	79,200,000 fc	300 fc	79,200,000	.....	July, 1930	300 fc
*Union Miniere, privilege sh	Belgian Congo	300,000	500 fc	206 fc	61,800,000 fc	206 fc	61,800,000 fc	.....	July, 1930	206 fc
Van Ryn Deep	Transvaal	1,196,892	£1	7s	£418,912	6s	£359,067	.....	Dec., 1930	3s
Van Ryn Gold	Transvaal	500,000	£1	1s	25,000	1s	25,000	.....	Dec., 1930	6d
West Springs	Transvaal	1,793,000	£1	2s	179,300	2s	179,300	.....	Aug., 1930	1s
Witwatersrand Gold	Transvaal	469,625	£1	6d	11,741	2s	46,962	.....	Dec., 1930	1s
Mines in Australia										
*Broken Hill South	New South Wales	800,000	£1	5s 6d	£220,000	5s	£200,000	.....	Nov., 1930	6d
Electrolytic Zinc, common	Tasmania	1,100,000	£1	2s 4.8d	132,000	2s	110,000	£2,198,360	Sept., 1930	9. 6d
Electrolytic Zinc, pfd	Tasmania	1,500,000	£1	2s 4.8d	180,000	2s	150,000		Sept., 1930	9. 6d
Great Boulder Pty	Western Australia	1,750,000	2s	3d	21,875	.....	.....	.....	Dec., 1929	3d
*†North Broken Hill	New South Wales	700,000	£1	9s 6d	332,500	8s	280,000	.....	June, 1930	1s 6d
*Mount Lyell	Tasmania	1,289,195	£1	4s	257,839	2s	128,919	.....	Nov., 1930	1s
*Sulphide Corp., common	New South Wales	600,000	15s	1s 6d	45,000	2s 3d	67,500	.....	Jan., 1930	2s 3d
*Sulphide Corp., pfd	New South Wales	600,000	£1	2s	60,000	3s	90,000	.....	Jan., 1930	3s
*Zinc Corporation, common	New South Wales	658,616	10s	4s	131,723	3s 6d	115,288	.....	June, 1930	2s
*Zinc Corporation, pfd	New South Wales	245,692	£1	8s	98,277	7s 6d	92,134	.....	June, 1930	2s
Mines in Asia										
Balaghât Gold, common	India	212,530	10s	6d	£5,314	6d	£5,313	£181,724	Mar., 1930	6d
Balaghât Gold, pfd	India	95,400	10s	6d	2,385	6d	2,385			
*Burma Corporation	India	13,541,689	10 Ru	1s 6d	1,015,626	1s 2.4d	825,197	5,719,953	Aug., 1930	6.4d
Cen. Provinces Manganese	India	1,000,000	£1	4s 6d	225,000	4s 6d	225,000	2,219,500	Nov., 1930	1s 6d
Gopeng Consolidated	F.M.S.	395,768	£1	3s	59,365	3s 9d	74,206	1,750,000	Sept., 1930	6d
Malayan Tin	F.M.S.	800,000	5s	2s 6d	100,000	1s 10.4d	75,000	.....	Dec., 1930	9d
Nundydroog Mines	India	566,000	10s	2s 3d	63,675	2s 6d	70,750	2,946,029	Oct., 1930	9d
Oriental Consolidated	Korea	429,390	$10	.....	.....	$0.50	$214,695	$10,944,375	May, 1930	$0.50
Pengkalen, common	F.M.S.	360,000	5s	1s 6d	£27,000	1s 3d	£22,500	£4,415,000	April, 1930	3d
Pengkalen, pfd	F.M.S.	280,000	5s	2s	28,000	1s 9d	24,500			
†Southern Malayan Tin	F. M. S.	1,314,336	5s	1s 1½d	70,946	1s 6d	95,580	.....	June, 1930	4.5d

(a) Includes 5 per cent stock dividend in 1927, 1928, 1929, and 1930
(b) Gross dividends, before deduction of taxes
(c) Dividends paid on old shares, before change in capital structure
pe Represents Chilean pesos fr Represents French francs fc Represents Belgian francs Ru Represents rupees.
† Fiscal years ended June 30, 1929, and June 30, 1930.

Important Mining Securities in 1930

COPPER

Company	Exch.	High	Low	Last	Net Change	Sales
Anaconda	N. Y.	81⅛ Ap. 2	25 De. 17	30	—45⅛	8,314,772
Andes	N. Y.	37½ Ap. 2	10⅝ De. 17	13⅜	—19⅞	87,800
Arizona Com	B.	1.75 Ja.	1.12½ No.	1.37½	+.12½	73,525
Bwana M'Kub..	N. C.	5.75 Ja. 8	1.50 De. 15	1.50	—3½	75,400
California Cop...	S. F.	3.12½ Mh.	.25 Oc.	.50	—1½	30,937
Cal & Ariz	N. Y.	89⅛ Ja. 9	28⅛ De. 16	35	—48⅛	363,800
Cal. & Hecla	N Y.	33⅛ Ja. 7	7.75 De. 29	8.00	—21⅛	487,100
Cerro	N. Y.	65⅛ Ja. 6	21 De. 15	23½	—40	413,700
Chile Cop	N. Y.	65 Fe. 6	19 De. 22	19	—41	3,730
Con. Copperm..	N. C.	8.87½ Fe. 8	2 Se. 30	2.50	—2½	221,600
Copper Range..	N. C.	16½ Je. 27	5½ De. 15	6.00	—8	2,800
East Butte	B.	1.75 Ja.	.90 Au.	1.25	—.25	35,083
Granby Con	N. Y.	59⅛ Ap. 2	12 No. 12	16	—37	444,600
Greene Cananea	N. Y.	89 Ap. 30	38⅛ De. 22	40	—8½	1,730
Howe Sound	N. Y.	41⅛ Fe. 7	20 No. 10	23½	—14½	320,600
Hudson Bay	N. C.	14⅛ Fe. 13	3.50 No. 10	4.12½	—4½	441,700
Inspiration	N. Y.	30⅛ Fe. 7	6.75 De. 17	8	—18½	470,600
Iron Cap	N. C.	3 Ja. 2	.75 De. 10	.75	—1½	13,500
Isle Royale	B.	12½ Ja.	4.25 No.	5	—7½	46,718
Kennecott	N. Y.	62⅛ Fe. 7	20⅛ De. 17	23½	—35½	4,811,115
Magma	N. Y.	52⅛ Mh. 28	19⅛ De. 16	20½	—25½	194,600
Miami	N. Y.	33½ Fe. 6	7 De. 18	7.75	—20½	305,700
Mohawk	B.	52 Fe.	14 De.	14⅛	—28⅛	16,250
Mother Lode	N. Y.	2 Ja. 2	.50 De. 13	.50	—1½	185,400
Nevada Con	N. Y.	32⅛ Ja. 7	9 De. 17	10⅛	—18⅛	1,567,400
Noranda	N. C.	44⅛ Fe. 6	11½ De. 17	14⅛	—20⅛	418,000
North Butte	B.	5.62½ Ja.	1 Oc.	1☆	—1 1/8	202,409
Ohio Copper	N. C.	1.25 Ja. 6	.25 Oc. 23	.25	—1	431,200
Old Dominion...	B.	10⅛ Ja.	1.75 De.	2.75	—3½	32,128
Phelps Dodge...	N. Y	44⅛ Ap. 7	19⅛ De. 30	21	—17½	323,400
Quincy	N. C.	45 Ap. 5	6 Oc. 10	6	—8½	2,400
Roan Antelope..	N. C.	30⅛ Fe. 27	11⅛ De. 19	12⅛	—15½	63,500
St. Mary's M.L.	B.	28 Ja.	6 De.	8	—17⅛	28,350
Seneca Copper...	N. Y.	3.50 Ja. 29	1 De. 13	1.12½	—1⅛	188,400
Shattuck Denn..	N. C.	9⅛ Ja. 2	2½ Oc. 21	3	—5½	109,200
Sherritt Gordon.	T.	3.50 Ja.	.56 No.	.81	—2.33	1,825,275
Tennessee Corp.	N. Y.	17 Ap. 10	7.75 De. 16	8.25	—4½	244,920
United Verde Ex.	N. C.	16⅛ Mh. 21	6.50 Oc. 16	7.87½	—4⅛	179,500
Utah Copper	N Y.	225 Ja. 9	148 Se. 22	148	—92	145
Waite-Ack-Mont	T.	5.65 Mh.	1.40 Je.	2.05	—1.20	254,807
Walker	S. L.	4.60	1.47½	1.57½	—2.77½	118,101
Wenden	N. C.	.87½ Ja. 10	.06½ Oc. 10	.12⅛	—.62½	139,600

LEAD-ZINC-SILVER

Company	Exch.	High	Low	Last	Net Change	Sales
Ahumada Lead..	N. Y.	1.62½ Mh. 28	.25 De. 16	.25	—.25	165,500
Amer. Z. L. & S.	N. Y.	17⅛ Fe. 3	3.62½ De. 17	4.87½	—4½	342,300
A.Z.L.&S., pfd...	N. Y.	79½ Ja. 20	26⅛ De. 29	27½	—28	25,400
Bunker Hill & S	N. C.	95½ Ja. 4	48 De. 31	48½	—50½	6,700
Butte Cop. & Z	N. Y.	4.25 Fe. 20	1.25 De. 15	1.75	—1½	102,900
Butte & Superior	N. Y.	5.75 Ja. 6	.87½ De. 24	.87½	—4⅛	84,700
Callahan Z-L...	N. Y.	2.12½ Fe. 3	.62½ De. 20	.75	—.25	117,400
Canam Metals...	T.	.65	.12	.12	—.48	60,115
Chief Consol....	S. L.	1.85	.55	.55	—1.27½	55,302
Con. Lead & Z..	St. L.	6.50 Ja.	2 De.	2	—3½	12,522
Constitution....	S.	.32 Ja.	.05 Au.	.07	—.25½	.....
Dayrock	S.	2.80 Fe.	1.00 No.	1.00	—1.00	.....
Eagle-Picher....	C.	15 Fe.	4.87½ De.	5	—8	46,473
Eagle-P., pfd...	C.	102	100	100	—1	875
Eureka Bullion..	S. L.	.55	.14½	.15½	—27	230,492
Eureka Lilly....	S. L.	1.25	.19½	.20½	—.99½	250,475
Evans-Wallower	N. C.	6 Mh. 6	.62½ No. 7	1⅛	—4⅛	108,600
Federal M. & S.	N. Y.	185 Mh. 26	80 No. 12	90	—85	4,650
Fed.M.& S.,pfd.	N. Y.	100½ Mh. 17	85 De. 20	85	—11½	4,928
Golconda	S.	.87 Ja.	.30 Oc.	.34	—.47	.....
Grandview	S.	.17 Ja.	.04 De.	.04	—.11½	.....
Hecla Mining...	N. C.	14 Fe. 15	6.87½ De. 30	7	— 5½	40,800
Iron King	S. L.	.45	.17	...	.....	75,782
§Jack Waite	S.	.70 Ja.	.15 Oc.	.42½	+.05	.....
Keystone	S. L.	.27	.15	...	.....	3,200
Kootenay-Flor..	S.	.07½ Ja.	.00½ De.	.00½	—.06	.....
Lucky Tiger C..	K. C.	1.25 Ja.	.62½ Au.	.62½	—.62½	25,000
Mammoth	S. L.	1.00	.25	...	.....	6,750
Mexican Prem..	S.	2.04 Ja.	.15 De.	.16	—1.86	.....
National Lead..	N. Y.	189½ Fe. 7	114 De. 17	116	—18½	98,600
Nat. Ld., pfd. A	N. Y.	144 Se. 5	135 De. 17	135⅜	—2½	8,340
Nat. Ld., pfd. B	N. Y.	120 No. 28	116 Ja. 17	118	+1	5,650
New Jersey Zinc	N. C.	91½ Mh. 19	45 De. 17	51⅛	—15⅛	61,500
New Quincy....	S. L.	1.40	.02½	.02½	—1.17½	1,116,290
Noble Five	S.	.39 Ja.	.01 No.	.04½	—.33½	.....
North Lily	S. L.	2.75	.65	1.05	—1.27½	84,169
Park Bingham..	S. L.	.08½	.00½	.01	—.04½	492,215
Park City Con..	S. L.	.75	.20	.23½	—.46½	309,320
Park Utah	N. Y.	4.37½ Ap. 7	1.12½ De. 26	1.25	—1½	189,400
Pend Oreille....	S.	3.00 Ja.	.50 Au.	.65	—2.00	.....
Rico Argentine..	S. L.	.15½	.03	.03½	—.13½	154,050
St. Joseph Lead.	N. Y.	57½ Fe. 6	19½ De. 17	25	—23½	372,400
Sherman Lead..	S.	.82½ Ja.	.39½ Jy.	.47	—.27½	.....
Silver King C...	S. L.	10⅛	5	5.20	—4⅛	79,385
Silversmith....	S.	.06	.01	...	.....	.....
Sunshine Min...	S.	4.60 Ja.	1.40 Jy.	1.42	—3.33	.....
Tamarack & Cust	S.	.64 Fe.	.29 No.	.29½	—.24½	.....
Tintic Stand'rd.	S. L.	10⅛	4	4.25	—6½	83,156
Tonopah Belm't	N. C.	.37½ Ja. 20	.06½ My. 8	.06½	—.31½	2,500
Treadwell Yuk..	T.	7.00 Ja.	.75 De.	1.25	—5.75	17,967
United Zinc Sm.	N. C.	4 My. 14	2 Ja. 29	3.50	—3½	4,100
Utah Apex	B.	3.75 Mh.	1 Oc.	1	—1½	38,549
Utah Met.&Tun.	B.	.90 Mh.	.20 Oc.	.25	—.40	65,947
Yellow Pine....	L. A.	.31 Je.	.06⅛ De.	....	.....	.....

GOLD AND SILVER

Company	Exch.	High	Low	Last	Net Change	Sales
Alaska Juneau..	N. Y.	9.12½ Ja. 7	4.50 Je. 18	7.25	—.87½	665,800
Barry-Hollinger.	T.	.25½ Mh.	.05½ De.	.07½	—.09½	1,308,390
Carnegie Metals.	N. C.	8.50 Ap. 3	1.87½ De. 19	1.87½	—3½	14,400
Castle-Treth....	T.	.28 Ja.	.15 Ja.	.18	—.07	221,700
Cen. American..	P.	.45	.45	.45	Unch.	1,000
Cen. Manitoba..	T.	.29 Ja.	.04¾ No.	.06	—.17	468,795
Coniagas	T.	1.40	.50	.55	—.70	9,172
Coniaurum	T.	.55	.17	.35	Unch.	21,989
Consol. Cortez..	N. C.	.12½ Ja. 3	.06½ Ja. 2	.06½	—.06½	45,400
Cresson Consol..	N. C.	.50 Ja. 17	.25 No. 8	.31½	+.06½	83,300
Dome Mines	N. Y.	10⅛ Se. 10	6.75 Ja. 3	8.87½	+2⅛	153,600
Golden Cycle C..	C. S.	16 Mh. 21	11⅛ No. 25	13	—1½	9,223
Hollinger Con....	T.	7.00 Ap.	4.95 Fe.	6.35	+1.30	274,754
Homestake	N. Y.	83 Se. 26	72 Jy. 12	79⅛	—.50	8,500
Keeley	T.	.42 Fe.	.27 Oc.	.27	—.06	170,408
Kerr Lake	N. C.	.50 Ap. 25	.06½ Ja. 16	.12⅛	—.06½	2,300
Kirkland Lake...	T.	.94 Fe.	.35 No.	.55	+.01	1,048,862
Lake Shore	T.	24⅛ Se.	19 Ja.	23 7/16	+4 3/16	177,918
McIntyre Porc..	N. Y.	19⅛ Ap. 23	14⅛ Ja. 2	20⅛	+5⅛	41,500
Mining Corp....	T.	3.60 Fe.	.50 Oc.	1.45	—1½	478,207
Montana Mines.	S.	.54 Je.	.12 De.	.12⅛	—.34⅛	.....
Natomas	S. F.	28	19⅛	19⅛	—4⅛	4,390
N.Y. & Hond.R.	N. C.	16 Ja. 6	9 Je. 14	10	—6	6,400
Nipissing	N. C	1.87½ Mh. 27	.93½ Oc. 16	1.12½	—.37½	43,500
Portland	C. S.	.05 Ja. 25	.01 Au. 27	.01	—.04	2,669
Premier Gold....	N. C.	1.62½ Ja. 7	.62½ No. 12	.68½	—.93⅛	104,000
Rand Mines	N. Y.	37½ Ja. 8	27⅛ De. 17	27⅛	+2⅛	1,090
Siscoe	T.	.65 Ja.	.24 My.	.40	—.03	1,430,701
Sylvanite	T.	1.02 Ja.	.40 Au.	.48½	+.07½	368,565
Teck-Hughes...	T.	7.30 Je.	4.85 Ja.	6.15	+1.10	1,192,295
Tom Reed	L. A.	1.00 Jy.	.40 Ja.	.53	+.01	.....
Tonopah Min..	N. C.	2 Ja. 6	.50 No. 15	.62½	—1⅛	8,600
United Eastern..	N. C.	.37½ Ja. 13	.06½ My. 13	.06½	—.12½	4,100
United Gold....	C. S.	.10⅛ Ja. 3	.07 Se. 23	.07½	—.02½	68,200
Vipond Cons....	T.	1.42 Je.	.62 Fe.	1.00	+.34	1,535,831
Wright-Harg....	T.	2.30 Je.	1.33 Ja.	1.90	+.55	1,397,350
Yukon Gold....	N. C.	.62½ Ja. 16	.25 Au. 2	.25	—.25	12,600

MISCELLANEOUS

Company	Exch.	High	Low	Last	Net Change	Sales
Alum'm Co. Am.	N. C.	356 Ap. 14	140½ De. 30	146½	—143	61,050
Aluminum, pfd..	N. C.	111⅛ Se. 9	104 De. 17	106½	—2½	39,200
American Metal	N. Y.	51½ Fe. 7	13½ De. 15	17	—29⅛	348,900
Amer. Met., pfd	N. Y.	116 Fe. 18	80 De. 29	80	—32½	7,300
Amer.Sm.& Ref.	N. Y.	79½ Ap. 2	37⅛ De. 29	41	—31⅞	1,423,650
A.S. & R. 2nd pf.	N. Y.	103⅜ Au. 14	93⅜ De. 31	93⅜	New	25,500
A.S. & R., pfd..	N. Y.	141 Ap. 8	131 De. 15	131½	—3⅜	35,200
A. C. Nitrate...	N. C.	43⅜ My. 13	8 De. 23	8	—10⅛	239,400
Asbestos Corp..	M.	3.75 Mh.	.25 Au.	.37½	—2⅛	16,842
Asbestos, pfd...	M.	15 Mh.	1 Oc.	1	—11	4,412
Con. Mng. & S..	M.	280 Fe.	120 Oc.	145	—109	59,128
De Beers Consol	N. Y.	14 Au. 2	8.25 Oc. 7	8.25	—5⅛	16,750
Feder'ed Metals	N. C.	24⅛ Ap. 14	8 De. 17	10⅞	—12⅛	17,800
Freeport Texas..	N. Y.	55⅛ Ap. 11	24⅛ De. 16	29⅛	—10⅛	1,246,800
Int. Nickel.....	N. Y.	44⅛ Ap. 4	12⅛ De. 16	15⅛	—17⅛	13,456,218
Int. Nickel, pfd.	N. Y.	123 Ap. 23	114 De. 26	114	—2⅛	9,000
Mayflower Asso.	N. C.	69⅛ My. 29	35 De. 16	40½	—10⅛	56,400
Met. & Min. Sh.	N. C.	16⅛ My. 1	12⅛ De. 29	.25	—9⅛	241,085
Newmont	N. C.	141⅛ Ap. 4	37⅛ De. 30	43⅛	—63⅛	289,600
Patiño M. & E..	N. Y.	32⅞ Fe. 5	8.12½ De. 15	11	—17⅛	230,750
S.Amer. G. & P.	N. C.	2.37½ Fe. 25	1 Jy. 8	1	—.50	39,200
Texas Gulf Sul..	N. Y.	67⅛ Mh. 24	40½ De. 17	46½	—8⅛	1,693,100
U. S. S. R. & M.	N. Y.	36⅛ Ja. 6	17⅞ Jy. 10	19	—15⅛	311,600
U. S. S. R., pfd.	N. Y.	53⅛ Ja. 7	40 De. 23	40½	—9⅛	27,200
Vanadium Corp.	N. Y.	143½ Ap. 26	44⅛ No. 7	52⅛	+2⅛	13,941,900
Ventures, Ltd...	T.	3.50 Ja.	.30 De.	.35	—2.55	711,331

ON THE LONDON MARKET

Company	High	Low	Last	Net Change
Anglo American	32/6	10/1½	11/10	— 17/7
Aramayo Mines	39/4½	19/-	20/-	— 25/-
Burma Corporation	15/4½	8/-	8/7½	— 6/6
Bwana M'Kubwa	24/3	5/7½	6/3	— 15/-
Camp Bird	1/6	4½d.	7½d.	— 10½d.
Frontino & Bolivia	10/-	6/3	.....	.....
Lake View & Star	13/10½	6/7½	8/9	— 4/11
Mount Isa	29/9	13/9	16/3	— 8/9
Mount Lyell	37/3	15/-	17/6	— 19/4
N'Changa Copper	88/-	30/-	35/-	— 1/3
Oriental Consolidated	11/3	6/3	10/-	— 1/3
Rhodesian Anglo-American	39/4½	11/3	11/10½	+ 18/1½
Rhodesian Congo Border	426/8	120/-	137/6	— 5/-
Rhodesian Select. Trust	55/-	14/11½	16/3	.....
Rio Tinto	950/-	545/-	575/-	—280/-
St. John del Rey	19/4½	16/-	17/6	+ 6d.
San Francisco Mines	26/9	13/-	14/6	— 11/9
Santa Gertrudis	11/3	7/4½	9/-	— 1/6
Tanganyika	46/3	24/3	26/10	—12 /6½
Wiluna Gold	19/6	13/3	15/-	.....
Zinc Corporation	38/1½	11/3	20/-	—21/3

§ Jack Waite shares changed at the rate of 1 for 5 during year, prices given on the new basis. N. Y., New York Stock Exchange; N. C., New York Curb Market; B., Boston Stock Exchange; B.C., Boston Curb; S.F., San Francisco; T., Toronto Standard Stock and Mining Exchange; S.L., Salt Lake City; St. L., St. Louis; S., Spokane Standard Stock Exchange; C., Cincinnati; P., New York Produce Exchange; K.C., Kansas City; C.S., Colorado Springs; L.A., Los Angeles; M., Montreal.

ANNUAL REVIEW NUMBER

United States Commerce in Ores and Metals

From U. S. Government sources

Twelve-month periods ending with December
Figures in pounds, unless otherwise stated

I—Copper

	1929	1930
Imports		
Ore, concentrate, matte	180,452,292	162,893,826
Unrefined, black, blister	646,167,055	560,469,147
Refined	134,014,792	86,210,331
Old	13,598,166	7,499,000
Total	974,232,305	817,072,304
Exports		
Refined	822,453,924	599,163,768
Rods	81,087,829	75,137,814
Wire	16,868,636	15,750,425
Cable	25,080,448	20,545,289
Other forms, including scrap	37,635,489	33,875,640
Total	983,126,326	744,472,936

II—Lead

Imports		
On ore and matte	62,661,371	78,753,878
In bullion	166,141,916	77,260,580
In pigs, bars, and other forms	3,315,481	609,296
Type metal, lead content	4,849,979	550,444
Total	236,968,747	157,174,198
Exports		
In pigs and bars	144,521,263	95,945,016
From domestic ore	38,515,061	8,085,414
From foreign ore	106,006,202	87,859,602
Manufactures	13,176,213	4,665,447
Total	302,218,739	196,555,479

III—Zinc

Imports		
Ore (duty paid)	28,821,787	51,678,775
Ore (duty free)	1,696	96,508
Blocks and pigs	451,474	694,413
Total	29,274,957	52,469,696
Exports		
Ore, concentrate, and dross	7,106,221	2,323,514
Slabs, blocks, and pigs	28,688,350	8,163,017
Sheets, strips, and other forms	10,529,333	8,837,606
Zinc dust	2,511,381	2,354,220
Other zinc manufactures	1,244,016	1,976,360
Total	50,079,301	23,654,717

IV—Gold and Silver

Imports		
Gold, value	$291,648,632	$396,053,695
Silver, value	63,939,830	42,760,841
Exports		
Gold, value	$116,582,926	$115,967,332
Silver, value	83,407,197	54,156,584

V—Exports of Minor Metals and Minerals

Aluminum: Ingots, scrap	613,366	607,608
Manufactures	18,885,259	18,586,211
Nickel, metal and alloys	2,869,686	2,839,446
Platinum, oz	2,567	1,037
Tin bars	1,768,891	188,520
Tin manufactures, value	$1,870,717	$1,089,881
Sand and gravel, tons	434,265	288,473
Cement, hydraulic, bbl	885,321	755,778
Fireclay, tons	68,358	55,946
Other clays, tons	68,562	65,955
Asbestos, unmanufactured, tons	633	688
Brake lining, lin.ft	7,426,622	6,716,521
Other asbestos manufactures	15,460,434	15,145,141
Gypsum, crude, crushed or ground, tons	3,777	3,217
Plaster, board and wall board, sq.ft	18,420,455	16,677,518
Plaster, calcined and manufactures, lb	49,157,296	40,016,917
Mica and manufactures	6,187,270	4,732,864
Sulphur, tons	855,183	598,220
Salt	218,443,167	140,956,301
Graphite and manufactures, except crucibles	3,226,857	3,112,832
Phosphate, high-grade hard rock, tons	67,474	65,992
Sand, pebble, and other phosphate rock, tons	1,075,272	1,159,129
Borax	159,767,825	165,862,630
Ocher, umber, sienna, whiting	41,959,784	45,132,189
Magnesia salts	695,172	601,015

VI—Imports of Minor Metals and Ores

Aluminum, metal, scrap, and alloy	48,415,921	24,498,544
Antimony in ore	3,729,180	1,726,031
Metal	26,859,614	17,012,268
Cobalt	1,241,083	659,893
Platinum, oz	115,221	106,155
Iridium, oz	4,470	4,196
Osmium and Osmiridium, oz	7,977	6,754
Palladium, oz	24,364	18,506
Rhodium and Ruthenium, oz	3,031	3,610
Quicksilver	1,086,221	223,686
Nickel: Ore and matte	28,981,343	20,593,361
In pigs, ingots, and other forms	64,420,873	38,323,029
Manganese ore (manganese content), tons	323,415	281,459
Chrome ore, tons	317,630	330,531
Tin, bars, blocks, pigs	195,165,173	180,844,329
Tungsten (tungsten content)	6,809,965	3,613,832
Ferrochromium, chromium metal, and chrome-vanadium	1,494,777	363,054
Ferrosilicon (silicon content)	21,110,090	11,621,109

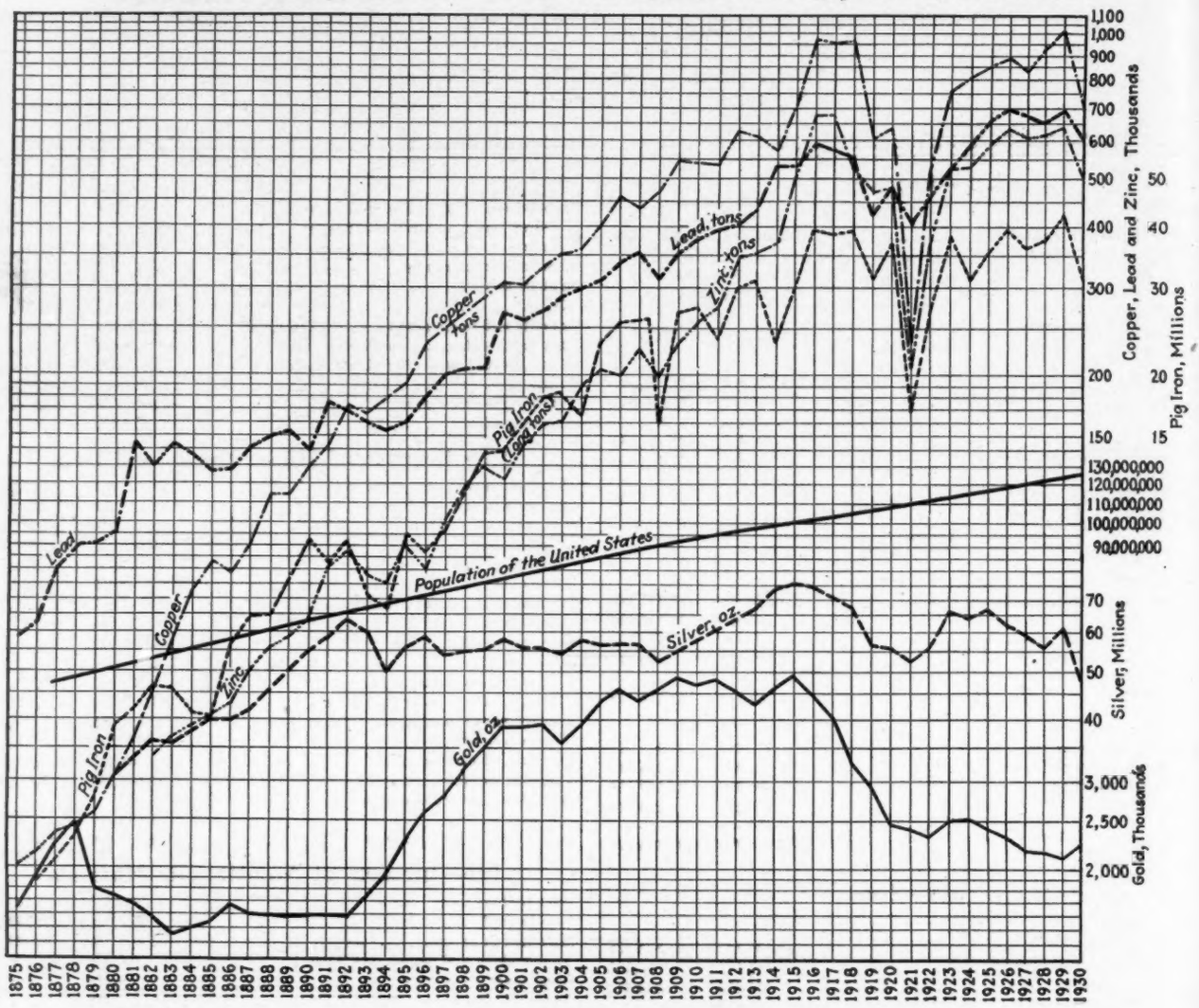
VII—Imports of Non-Metallic Minerals

Bauxite, tons	380,812	415,058
Marble, cu.ft	727,040	749,642
Lime and limestone	65,695,646	59,580,352
Kaolin, china and paper clays, tons	249,921	210,911
Other clays, n.e.s., tons	62,419	48,189
Corundum, tons	3,378	2,794
Emery, tons	5,717	3,796
Flint, tons	12,542	6,121
Asbestos, manufactured (includes crude, mill fiber, and stucco), tons	234,309	286,323
Asbestos, manufactured	56,307,187	3,914,841
Cryolite, tons	7,778	8,315
Chalk, crude, tons	102,563	102,866
Fluorspar, tons	48,522	57,949
Gypsum, crude, tons	925,344	801,377
Mica, crude	1,317,406	4,555,295
Mica, cut, split	5,556,195	2,749,073
Diamonds, rough, carats	354,367	209,591
Cut, unset, carats	416,992	295,351
Pyrites, tons	514,336	368,114
Talcum, steatite, French chalk	62,493,839	50,423,746
Magnesite	106,364,569	102,389,752
Salt	91,675,331	108,529,973
Graphite	47,922,028	33,451,421
Mineral wax	9,791,090	12,474,894
Iodine, crude	627,162	493,587
Nitrate, sodium, crude, tons	12,800	12,799
Ochers and sienna	22,033,745	14,576,024
Lithopone and other zinc pigments	19,578,476	15,042,348
Potash, crude chloride, tons	230,966	273,211
Crude sulphate, tons	79,510	86,257
Kainite, tons	75,930	112,176
Manure salts, tons	39,828	361,688

VIII—Iron Ore and Pig Iron

Exports		
Iron ore, tons	1,304,417	752,267
Pig iron, tons	46,357	13,671
Imports		
Iron ore and concentrate, tons	3,139,334	2,775,124
Pig iron, tons	147,763	137,031

Metal Production of the United States, 1875-1930



Yearly Average Prices of Principal Metals, 1899-1930

in New York, St. Louis, and London

Prices in New York or St. Louis, cents per pound, except quicksilver (dollars per flask), and silver and platinum (dollars per ounce). London quotations, pounds sterling per long ton, except silver (pence per ounce)

	Copper		Lead		Tin		Zinc		Silver		Anti-mony,	Quick-silver,	Plat-inum,
Year	Electrolytic New York	Standard London	New York	London	(b) New York	(a) London	St. Louis	London	New York	London	New York	New York	New York
1899	16.67	.....	4.47	14.933	25.12	122.429	.....	.....	59.580	27.438	9.430	43.63	15.22
1900	16.19	.....	4.37	16.987	29.90	133.575	.....	.....	61.330	28.250	9.500	51.00	18.09
1901	16.11	.....	4.33	12.521	26.74	118.633	.....	.....	58.950	27.188	8.250	47.00	20.00
1902	11.626	52.460	4.069	11.262	26.79	120.720	.....	.....	52.160	24.090	6.120	48.03	19.00
1903	13.235	57.970	4.237	11.579	28.09	127.320	5.191	.....	53.570	24.750	6.000	41.32	18.91
1904	12.823	58.884	4.309	11.983	27.99	126.733	4.931	.....	57.221	26.399	6.371	41.00	19.50
1905	15.590	69.465	4.707	13.719	31.358	143.083	5.730	25.433	60.352	27.839	10.250	38.50	20.34
1906	19.278	87.282	5.657	17.370	39.819	180.646	6.048	27.020	66.791	30.868	21.730	40.90	28.04
1907	20.004	87.007	5.325	19.034	38.166	172.638	5.812	23.771	65.237	30.188	14.840	41.50	30.98
1908	13.208	59.902	4.200	13.439	29.465	133.124	4.578	20.163	52.864	24.402	8.004	44.84	16.32
1909	12.982	58.732	4.273	13.042	29.725	134.774	5.352	22.185	51.502	23.706	7.466	46.30	24.87
1910	12.738	57.054	4.446	12.920	34.123	155.308	5.370	23.050	53.486	24.670	7.386	47.06	32.70
1911	12.376	55.973	4.420	13.970	42.281	192.353	5.608	25.281	53.340	24.592	7.540	46.54	42.12
1912	16.341	72.942	4.471	17.929	46.096	209.420	6.799	26.421	60.835	28.842	7.760	42.46	45.55
1913	15.269	68.335	4.370	18.743	44.252	201.679	5.504	22.746	59.791	27.573	7.520	39.54	44.88
1914	13.602	61.524(c)	3.862	19.076(c)	34.301(d)	156.564(c)	5.061	22.544(c)	54.811	25.314	8.763	48.31	45.14
1915	17.275	72.532	4.673	22.917	38.590	163.960	13.054	67.533	49.684	23.675	30.280	87.01	47.13
1916	27.202	116.059	6.858	31.359	43.480	182.096	12.634	72.071	65.661	31.315	25.370	125.49	83.40
1917	27.180	124.892	8.787	30.500	61.802	237.563	8.730	52.413	81.417	40.853	20.690	106.30	102.82
1918	24.628(e)	115.530	7.413	30.100	(f)	330.138	7.890	54.180	96.771	47.516	12.581	123.47	105.95
1919	18.691	90.796	5.759	28.590	63.328	257.601	6.988	42.879	111.122	57.079	8.190	92.15	114.61
1920	17.456	97.480	7.957	37.832	49.101	295.866	7.671	44.372	100.900	61.590	8.485	81.12	110.90
1921	12.502	69.356	4.545	22.752	29.916	165.265	4.655	25.845	62.654	36.886	4.957	45.46	75.03
1922	13.382	62.123	5.734	24.097	32.554	159.450	5.716	30.003	67.521	34.406	5.471	58.946	97.618
1923	14.421	65.840	7.267	27.147	42.664	202.148	6.607	33.058	64.873	31.926	7.897	66.502	116.537
1924	13.024	63.149	8.097	34.421	50.176	248.737	6.344	33.728	66.781	33.969	10.836	69.761	118.817
1925	14.042	61.920	9.020	36.429	57.893	260.974	7.622	36.624	69.065	32.088	17.494	83.128	119.093
1926	13.795	57.971	8.417	31.075	65.285	291.016	7.337	34.105	62.107	28.686	15.988	91.903	113.269
1927	12.920	55.653	6.755	24.192	64.353	288.953	6.242	28.513	56.370	26.046	12.393	118.159	84.636
1928	14.570	63.703	6.305	21.060	50.427	227.131	6.027	25.284	58.176	26.746	10.305	123.506	78.580
1929	18.107	75.416	6.833	23.246	45.155	203.850	6.512	24.790	52.993	24.460	8.956	122.145	67.655
1930	12.982	54.611	5.517	18.077	31.694	141.873	4.556	16.570	38.154	17.666	7.667	115.009	45.358

(a) Standard tin; prices from 1899 to 1914 from statistical report of Metallgesellschaft, Frankfurt-am-Main. (b) 99 per cent tin, 1899 to 1919; Straits tin 1920 to 1930. (c) Average of nine months, no quotations being made during August, September, and October. (d) Average of eleven months, no quotation being made in August. (e) Average of eleven months, no quotation being made in December. (f) No average computed.

Personal Notes . . . Comment . . . Criticism

Dr. Harrison Schmitt, consulting mining geologist, announces the opening of an office in the Mills Building, El Paso, Tex.

D. McK. Young has resigned from the staff of the Royal Development Company, and will establish headquarters in San Francisco after Feb. 15.

T. C. Foster was re-elected State Mines Inspector for Arizona at the recent election, and has reappointed his entire staff of deputy inspectors.

Charles Butters, of San Francisco, was recently the recipient of a medal given by the Mining and Metallurgical Society of Freiburg, Germany, for outstanding work in mining and metallurgy.

Dr. W. R. Ingalls, director of the American Bureau of Metal Statistics, New York, will lecture on "The Wealth of Nations," before the Franklin Institute at Philadelphia, on March 18.

H. R. Robbins, consulting metallurgical engineer for Oriental Consolidated, has returned to the United States from Korea and will make his headquarters at the company's New York office, at 15 William St.

Gardner Edwards, for the last five years assistant superintendent of the Ahmeek mine of Calumet & Hecla Consolidated, left late in January for M'Kana, Northern Rhodesia, where he has accepted a position as mine superintendent for Bwana M'Kubwa.

Louis S. Cates, president of the Phelps Dodge Corporation, has been elected president of the Mining and Metallurgical Society of America, succeeding **G. Temple Bridgman. C. M. Weld,** of New York, was made vice-president, and **W. D. B. Motter** secretary and treasurer.

Dr. J. V. N. Dorr has been elected president of United Engineering Trustees, formerly known as the Engineering Foundation. This organization represents the A.S.C.E., A.I.M.E., A.S.M.E., and A.I.E.E. in the administration of the Engineering Societies Building in New York, and of funds for research.

Bela Low, mining engineer, and **Sherwin F. Kelly,** geologist and geophysicist, announce their association to provide a consultation service in which mining, geology, and geophysics will be co-ordinated. They are prepared to advise if geophysics can be helpful in solving given problems, and what methods are best adapted. The partnership has established headquarters in New York City.

O. C. Martin, consulting metallurgist with Union Minière and Société Générale Métallurgique de Hoboken, will be given an honorary degree on the occasion of the dedication of the new chemistry hall, Indiana University, at Bloomington, in April. For the past six years Mr. Martin has directed the construction of, and put into successful operation, a large copper refinery at Oolen, Belgium.

F. J. Noel, for several years manager of the Sullivan Machinery Company's office in Santiago, Chile, is now representative in New York State, with headquarters at Syracuse. His position at Santiago has been filled by the appointment of **James W. Hazen. Chauncey B. Wightman,** for the past two years in charge of the company's office in Brazil, has been appointed manager at Mexico City, taking the place of **O. J. Neslage,** who goes to occupy a similar position at Salt Lake City, Utah.

Abbot A. Hanks, whose father, H. G. Hanks, established the original firm, now known as Abbot A. Hanks, Inc., in 1864 in Inyo County, Calif., and moved to San Francisco in 1866, recently installed a 300,000-lb. Riehle testing machine, probably the largest in commercial testing laboratories on the Pacific Coast. Control of construction materials is a feature of the work now done by the firm, although its assaying and chemical work continues to be important.

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State Geologists

Through the courtesy of George C. Branner, secretary, Association of American State Geologists, is appended below a list, revised as of Jan. 1, 1931, of the members of the association:

Alabama—Dr. Walter B. Jones, State Geologist, Geological Survey of Alabama, University, Ala.
Arizona—Dr. G. M. Butler, Director, Arizona Bureau of Mines, University of Arizona, Tucson, Ariz.
Arkansas—George C. Branner, State Geologist, Arkansas Geological Survey, 443-447 State Capitol, Little Rock, Ark.
California—Walter W. Bradley, State Mineralogist, State Division of Mines, Ferry Building, San Francisco, Calif.; Olaf P. Jenkins, Chief Geologist, State Division of Mines, Ferry Building, San Francisco, Calif.
Colorado—Dr. M. F. Coolbaugh, Secretary, Geological Board, Colorado Geological Survey, Golden, Colo.
Connecticut—Dr. W. E. Britton, Superintendent, State Geological and Natural History Survey, P. O. Box 1106, New Haven, Conn.
Florida—Herman Gunter, State Geologist, State Geological Department, Martin Building, Tallahassee, Fla.
Georgia—S. W. McCallie, State Geologist, State Geological Department, Atlanta, Ga.
Idaho—John W. Finch, Director, Bureau of Mines and Geology, Moscow, Idaho.
Illinois—Dr. M. M. Leighton, Chief, State Geological Survey Division, Department of Registration and Education, Urbana, Ill.
Indiana—Dr. W. N. Logan, State Geologist, Divison of Geology, State Department of Conservation, Indianapolis, Ind.
Iowa—Dr. George F. Kay, Director, Iowa Geological Survey, Des Moines, Iowa.
Kansas—Dr. R. C. Moore, State Geologist, State Geological Survey of Kansas, Lawrence, Kan.
Kentucky—Dr. W. R. Jillson, State Geologist, Kentucky Geological Survey, Frankfort, Ky.
Maryland—Dr. Edward B. Mathews, State Geologist, Maryland Geological Survey, Johns Hopkins University, Baltimore, Md.
Michigan—Dr. Richard A. Smith, State Geologist, Geological Survey Division, State Department of Conservation, Lansing, Mich.
Minnesota—W. H. Emmons, Director, Minnesota Geological Survey, University of Minnesota, Minneapolis, Minn.
Mississippi—Dr. E. N. Lowe, Director, Mississippi Geological Survey, University, Miss.
Missouri—Dr. H. A. Buehler, State Geologist, State Bureau of Geology and Mines, Rolla, Mo.
Montana—Dr. Francis A. Thomson, Director, State Bureau of Mines and Geology, Butte, Mont.
Nebraska—G. E. Condra, State Geologist and Dean of Conservation, Survey Division, University of Nebraska, Lincoln, Neb.
Nevada—Dr. J. Claude Jones, Geologist, Nevada State Mining Laboratory, Mackay School of Mines, University of Nevada, Reno, Nev.
New Jersey—Dr. H. B. Kummel, Director and State Geologist, State Department of Conservation and Development, Trenton, N. J.
New Mexico—E. H. Wells, State Geologist, New Mexico School of Mines, Socorro, N. M.
New York—D. H. Newland, State Geologist, University of the State of New York, Albany, N. Y.
North Carolina—H. J. Bryson, State Geologist, Division of Mineral Resources, State Department of Conservation and Development, Raleigh, N. C.
North Dakota—Dr. A. G. Leonard, State Geologist, State Geological Survey, University of North Dakota, University, N. D.
Ohio—Wilbert Stout, State Geologist, Geological Survey of Ohio, Columbus, Ohio.
Oklahoma—Dr. C. N. Gould, Director, Oklahoma Geological Survey, Norman, Okla.
Pennsylvania—Dr. George H. Ashley, State Geologist, Topographic and Geologic Survey, Harrisburg, Pa.
Rhode Island—Prof. Charles W. Brown, Superintendent, Natural Resources Survey of Rhode Island, Providence, R. I.
South Carolina—Dr. Stephen Taber, State Geologist, Department of Geology, University of South Carolina, Columbia, S. C.
South Dakota—Dr. E. P. Rothrock, State Geologist, State Geological and Natural History Survey, Vermillion, S. D.
Tennessee—Walter F. Pond, State Geologist, Division of Geology, State Department of Education, Nashville, Tenn.
Texas—Dr. E. H. Sellards, Associate Director, Bureau of Economic Geology, Division of Conservation and Development of Natural Resources, University of Texas, Austin, Tex.
Utah—William Peterson, State Geologist, Agricutural College of Utah, Logan, Utah.
Vermont—Dr. George H. Perkins, State Geologist, University of Vermont, Burlington, Vt.
Virginia—Dr. Arthur C. Bevan, State Geologist, State Geological Survey, University, Va.
Washington—Dr. Harold E. Culver, Supervisor, Division of Geology, State Department of Conservation and Development, Pullman, Wash.
West Virginia—James D. Sisler, State Geologist, West Virginia Geological Survey, Morgantown, W. Va.
Wisconsin—E. F. Bean, Director, State Geological and Natural History Survey, Science Hall, Madison, Wis.
Wyoming—John G. Marzel, State Geologist, Geological Survey of Wyoming, Cheyenne, Wy.

OBITUARY

Dr. Earl Douglas, paleontologist, discoverer of the Vernal, Utah, dinosaur deposits, died recently in Salt Lake City, following an operation.

A. A. Codd, of Reno, Nev., died Jan. 19, 1931, at his home in Reno. He was a mine operator and promoter of mining properties, and was 60 years of age. Mr. Codd took part in the rush to Goldfield in 1904, and was later at Rochester, where he constructed the Nevada Short Line Railroad. Mr. Codd was active in operating various properties, and at one time was a regent of the University of Nevada.

Andrew Hunker, one of the pioneer prospectors in the Nome, Alaska, gold rush, died late in January at his home in San Francisco, Calif. He came to the United States in 1876 from the Black Forest country of Germany, and it is to relatives there that his wealth has been bequeathed. Mr. Hunker was 80 years of age, and had no relatives surviving him in the United States. Hunker Creek, north of Nome, Alaska, and several mining properties bear his name.

NEWS OF THE INDUSTRY

Mexico Lowers Taxes to Encourage New Mines

An attempt is being made by the Mexican government to encourage development of new mining properties in Mexico, of which there have been comparatively few within recent years. Production taxes during the next ten years will be discounted for new mines or for old mines which have resumed production after a complete suspension of operations, according to an announcement by the Minister of Finance.

New mines will have to pay only 50 per cent of the usual tax during the first two years of operation, 70 per cent during the next two years, and 90 per cent during the fifth year. In the case of reopened mines, the discounts apply for the first three years only. Production from new orebodies on properties already in operation will not be included.

One effect of the new proviso, Mexico City mining men point out, will be greatly to hasten the work of developing and equipping new prospects, since the discount starts with the inception of operations rather than of production.

Although Mexican mine production has increased within the last few years, the increase has come largely from properties already in operation which have either added to their ore deposits or, through improvements in metallurgy, have been able to improve extraction of metallic content. The stringent property requirements, unsettled labor conditions, and comparatively high taxes have militated against extensive prospecting for new mines.

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Release Ashley Drill Results

Mining Corporation of Canada has announced that the average assay of the ore cut in eight drill holes at the Ashley-Garvey property, in Bannockburn Township, Ont., was $10.68 in gold per ton. The average width was 4 ft. The vein varied from 3 to 8 ft. wide over a length of 525 ft. and was cut at depths of 85 to 278 ft. The vein was discovered in October and a small mining plant is now being installed. Ashley Gold Mining has been formed to operate the property. Its control is held by Mining Corporation.

■

Senate Approves Study of Copper Tariff

A resolution directing the tariff commission to investigate the cost of production in the United States and in foreign countries of all forms of copper mentioned in the free list of the tariff act was approved by the Senate on Feb. 5. Senators Hayden, of Arizona; Wheeler, of Montana; and Vandenberg, of Michigan, introduced the resolution. The investigation could not be ordered under the flexible provision of the tariff act because there is no duty on unmanufactured copper. The resolution therefore refers to Section 332 of the act which authorizes such investigations and reports to be made upon the request of the President or either branch of Congress. The tariff commission is asked to report on the differences in the cost of mining and smelting foreign and domestic copper for the last three calendar years, in order to make a proper comparison between marketing conditions in periods of prosperity and depression.

■

U.V.X. and Magma Managers Deny Rumors of Shutdown

Rumors that the United Verde Extension and Magma properties, two of the larger copper producers in central Arizona, might curtail copper production further or that they might close down entirely have been denied by the respective managers of the companies. U.V.X. produced 1,236 tons of copper in December and Magma produced 1,203 tons. Both figures are considerably lower than the average in 1929.

At a meeting of the Rotary Club of Superior, Ariz., where the Magma properties are situated, William Koerner, manager of the company, said that a four or five-week shutdown was planned, starting June 15. A similar shutdown was made in 1930. He stated emphatically, however, that the mine would not shut down before June 15.

George Kingdon, manager of U.V.X., operating at Jerome and Clemenceau, Ariz., states that a further reduction in the working force, now about 660 men, is not expected. A six-day week is in force at the mine.

■

Timberlake Proposes Clause for Depletion Revision

Representative C. B. Timberlake, of Colorado, introduced in the House of Representatives on Feb. 3 a bill that, with a reservation for cost or 1913 value, would permit basing mine depletion allowance for income tax purposes on 33⅓ per cent of net income before depletion, after depreciation. Presented in the form of an amendment to the revenue laws, the bill embodies the recommendation made by mine operators at the hearing last December, before the joint Congressional committee on internal revenue taxation.

As the Ways and Means Committee will take no action on the bill prior to submission of the joint committee's report on the percentage depletion plan, it is not likely to receive any consideration until the regular session of the new Congress next December. The bill will be reintroduced at that time or possibly before, if a special session is called by President Hoover this summer.

Natural Gas for Arizona Mines Ready on Aug. 1

The mines at Bisbee and smelters at Douglas, in southern Arizona, will be able to use natural gas for fuel and power purposes by Aug. 1, if the present plans of the El Paso Natural Gas Company are fulfilled, publication of data on the financing of the company's new pipe line has revealed. A line is to be run 275 miles from El Paso to Bisbee and Douglas, via Deming, N. M. It will then be continued to Cananea, Sonora, Mexico. The line will consist of 12-in., 900-lb. pressure pipe, with four compressor stations. Ford, Bacon & Davis are preparing the plans, and Stone & Webster Engineering Corporation will build it.

The possibility that the copper companies in the Southwest might contract for natural gas from Mid-West fields first became publicly known in May, 1930. At that time it was announced that Phelps Dodge had signed a contract and that Calumet & Arizona and the Arizona Edison Company, which supplies light and power for domestic use in southern Arizona, were also negotiating. Later announcements were made that International Smelting, operating a copper smelter at Miami, had signed a contract, as well as C. & A. Financing of the scheme evidently delayed construction somewhat, for originally announcement was made that natural gas would be available at Douglas by March of this year.

According to the news release of the El Paso Natural Gas Company, plans have now been completed for financing the $6,000,000 project. No public financing is involved, as the three-year bonds that will be floated will be issued to Engineers Public Service Corporation, the mining companies, utilities, and other large consumers. Engineers Public Service also has an option to buy stock control of El Paso Natural Gas.

Natural gas is now used successfully in the El Paso copper and lead smelters and in the new Laredo antimony smelter, in Texas. C. & A. and Phelps Dodge operate copper smelters at Douglas, and Greene Cananea operates a smelter at Cananea. Oil is the principal fuel used. No mention is made, in the news release, of the projected line to Miami and Phoenix. Presumably that part of the enterprise has been at least temporarily postponed.

■

Columbia Grads to Convene

Though not announced in the advance publicity for the annual A.I.M.E. meeting in New York, Columbia School of Mines alumni will gather for a dinner at the Columbia University Club on Tuesday night, Feb. 17. All alumni of the mining school are invited.

Utah Copper Closes Deal for Bingham Dumping Rights

A substantial sum has been paid Bingham Metals by Utah Copper for certain dumping rights under a contract recently closed by Gibson Berry, manager of Bingham Metals, and the board of directors. The payment, made during the latter part of January, will be sufficient to finance development for the current year at the property, adjoining the United States and Utah Copper mines, at Bingham, Utah.

Bingham Metals has sunk its shaft to the 1,125 level and drifting has been started to explore the South No. 2, the East, and the Armstrong fissures. In the past, the Bingham Metals property has produced a considerable amount of gold-copper and silver-lead ore from fissures in the porphyry.

The hoist at the collar of the Nast incline shaft is being moved by Utah Copper to the 700 level of the Bingham Metals vertical shaft, which has been connected with the Armstrong tunnel of Utah Copper at a point 4,400 ft. from its portal.

In driving the Armstrong tunnel into Bingham Metals ground, Utah Copper cut a strong fissure carrying some gold. Bingham Metals has driven a crosscut to develop this showing in the north end of its ground on the 900 level.

■

Premier Gold Options T.O.B. in Kirkland Lake Area

Premier Gold, operating mines in British Columbia, has entered the Kirkland Lake district, Ontario, by taking over the option on the Tough-Oakes-Burnside property, formerly held by Bunker Hill Extension Mines. A new company, Toburn Gold Mines, is being formed, in which Bunker Hill Extension will participate in return for services performed in unwatering the mine. A considerable tonnage of new ore has been found near the old workings. M. W. Hotchkins, examining engineer for Bunker Hill Extension, has been retained by the new interests to direct development.

Premier Gold is controlled by American Smelting & Refining. Tough-Oakes-Burnside was one of the first discoveries of the Kirkland Lake district and the first property in that area to enter production. Operations were carried on spasmodically for several years. About $1,000,000 in gold was produced and about $300,000 paid in dividends. In 1928 the property reverted to the hands of its bondholders. It remained inactive until last fall, when Bunker Hill Extension secured an option.

■

Champion Now 25 Per Cent Under 1930 Output Rate

At the Champion mine of Copper Range, in the Michigan copper district, output is 25 per cent below the average rate in 1930. Production in 1930 was 20,000,000 lb., refined, and at the present rate of output, 15,000,000 will be produced this year. Champion has cut pumping costs by handling the heavy influx of water in No. 4 shaft from the No. 3 level instead of the No. 6, as formerly. The south end of Champion is overlaid by a deep bed of water-bearing overburden. Crushing caused a heavy inflow. By drilling the strata, the water has been diverted to the No. 3 level.

The Baltic mine of the Copper Range company, which produced 3,500,000 lb. of copper last year, is operating on about the same basis. Costs are under 10c. per pound. This low cost is achieved by removal of pillars, requiring no opening work, and mining high-grade rock. Pillars are being removed in upper levels, preparatory to final abandonment of the mine. A large tonnage remains to be taken out.

■

Clarence Woods Receives Placer Concession in Peru

Clarence Woods, president and manager of Inca Mining & Development, operating the Santo Domingo gold mine, in southeastern Peru, has been granted a special placer-mining concession by the Peruvian government that covers an area totaling 10,000 square miles along the Inambari River.

Under the terms of the concession, actual exploitation of the gold-bearing placer deposits is to begin by December of this year, following systematic mapping and exploration of the area. During the first year of exploitation a minimum of 1,000 tons of ore per day is to be treated; this daily average is to be increased by 1,000 tons each following year until the rate of 5,000 tons per day is reached at the end of the fourth year.

Ten per cent of the gross production is to be paid by the concessionaire to the government during the first year; 11 per cent, the second year; 12 per cent, the third year; and 15 per cent, the fourth year. This last amount will be the maximum participation of the government.

One of the first steps in the exploration of the area will be the preparation of an aërial photographic map of the territory. This work will be undertaken for Mr. Woods by the Shippee-Johnson expedition, which is in Peru photographing Inca ruins.

■

Park City Opens Oreshoots in Roosevelt Vein

Two shoots of silver ore have been opened up in the Roosevelt veins of Park City Consolidated in the East Park City district of Utah, as a result of recent exploration work on the 900 level. In drifting northeast on the Silver vein, in which an oreshoot 700 ft. long has been exposed, the heading struck the juncture of the Silver and the Roosevelt vein. In this fissure, which strikes easterly and westerly across the Park City Consolidated property for 7,000 ft., a shoot 70 ft. long has been proved. In a raise put up on an incline for 250 ft. this shoot shows a width of 5 ft. of ore, averaging 20 oz. of silver to the ton or better. Near the 700 level 3 ft. assayed 116 oz. of silver to the ton, and two railroad cars shipped from development assayed 48 and 36 oz. of silver to the ton each.

Work along the fissure to the east has exposed the second shoot in the Roosevelt fissure. This shoot, according to J. J. Beeson, general manager, has a width of 5 ft. for the 20 ft. exposed, with assays ranging from 20 to 80 oz. of silver a ton.

On the 400 level, the company is drifting south to cut several large fissures. On Feb. 1, when faced with a shutdown on account of the low price of silver, employees of the Park City Consolidated accepted a second wage cut, which makes the base wage $3.25 a day.

U. S. Senate Approves Bill for New Mines Building

The bill for establishment of a $350,000 experiment station for the U. S. Bureau of Mines on the campus of the University of Maryland at College Park, Md., passed the Senate on Jan. 26. Because of some opposition in the House Committee on Mines, to the project. Representative Sproul, of Kansas, chairman, has announced that a hearing will be held before the committee acts on the measure. The date of hearing has not been fixed. An amendment by Senator King, of Utah, which would have authorized an appropriation of $500,000 for a mineral and metals experiment station at Salt Lake City, was not brought up when the bill came up for consideration in the Senate.

At various times the Bureau's coal-testing laboratory, the research laboratory of the mineral technology division, the radioactivity laboratory, and the cryogenic laboratory were located in Washington, but with the need for space these laboratories were gradually crowded out and moved to various field stations. Finally, when the Bureau was transferred from the Interior to the Commerce Department it was necessary to remove the last remaining laboratory to a field station in Texas, so that at present the Bureau has no laboratory in or near Washington.

The station at College Park, according to Dr. Scott Turner, director, would afford relief from overcrowded conditions at other stations. This is particularly true with respect to the station devoted to non-metallics, now at New Brunswick, N. J., where it has been necessary to rent a building.

■

Russian Manganese Cannot Be Banned Now, Lowman States

Seymour Lowman, Assistant Secretary of the Treasury, informed the House Committee on Ways and Means on Jan. 28 that Russian manganese and anthracite could not be excluded from the United States, because evidence is lacking that they are produced by forced, indentured, or convict labor. He also stated that the importation of these commodities could not be barred under the anti-dumping law, because they sell in the United States at prices higher than in Russia. Testifying with reference to pending bills for tightening restrictions on importation of goods mined or produced by convict, forced, or indentured labor, Mr. Lowman explained that this proposed legislation would not be effective in prohibiting the importation of manganese, because it does not apply to the importation of commodities which are not produced in the United States in sufficient quantity to meet the domestic demand. Asked by Representative Garner what economic effect an embargo of Russian imports would have upon the United States, Mr. Lowman replied that the United States would lose an annual export trade of $130,000,000.

Mr. Lowman did not express any specific opinion on the merits of the proposed legislation, but he explained that if the present law were amended to exclude products that are not only mined or produced by convict labor, but are transported, handled, or loaded by such labor, certain products, such as lumber and pulpwood, could be barred. With reference to manganese, Mr. Lowman said that the Treasury Department would require proof that the United States could produce a sufficient supply before ordering exclusion of the Russian product.

EXCLUSIVE

CABLES

FROM CORRESPONDENTS IN THE PRINCIPAL MINING CENTERS

Malaya Still Undecided on Tin Quota Scheme

London, Jan. 31.—The tin position of the Federated Malay States is still uncertain, pending a decision by the government on whether it will or will not adopt the proposed scheme for restriction of tin exports on a quota basis. Adoption of the plan, which has been approved by Bolivia, Nigeria, and the Netherlands East Indies, is considered doubtful. A local suggestion has been made to levy 5c. per picul (142.7 lb.) of tin produced by all Malayan properties for the next three years. This money would be used in research work to increase tin consumption. The suggestion is strongly opposed.

. . . . Austral Malay Tin, one of the largest factors in the mining industry of the Federated Malay States, announces that in view of the current depression none of its six operating subsidiaries will pay dividends during 1931. The six companies are Kampong Kamunting, Asam Kumbang, Ula Yam, Thabawleik, Puchong, and Pungah.

. . . . East Geduld, which is developing a gold property adjoining Geduld Proprietary on the Far East Rand, in the Transvaal, estimates its ore reserves on Dec. 31, 1930, as 3,900,000 short tons averaging 7 dwt. in gold over a width of 58 in. This represents an increase during the last year of 500,000 short tons in tonnage, of 0.75 dwt. in value, and of 1 in. in width. Reserves are sufficient for more than five years of operation at the rate of 2,000 short tons daily. A plant of that capacity is now being built.

. . . . North Charterland Exploration, which has mining and surface rights over 10,000 square miles in Northern Rhodesia, has been granted the right to public inquiry regarding expropriation of part of its area for native reserves. This inquiry will open the entire question of the validity of titles in the Rhodesian colonies, most of them having been granted by the British South Africa (Chartered) Company. At present, Mining Trust is exploring the North Charterland concession.

. . . . Taquah & Abosso Mines, second largest gold producer on the Gold Coast, has reported that all the levels between Nos. 13 and 18 have now penetrated through the faults and are opening ore. Developments are satisfactory, the average grade of the 581 ft. of drifting on ore done during the last quarter having been 38s. 6d. in gold per long ton, compared with the average grade of 35s. 1d. for blocked-out reserves. Production has increased from about 8,500 tons monthly to 10,000 tons.

. . . . F. Allen, chairman of Ariston Gold, has recently left for the mine, which adjoins Taquah & Abosso, on the Gold Coast. He will report on its condition when he returns. Operations had to be suspended recently because of a run of ground. However, the skips are again working to the No. 16 level, and developments at that depth are reported satisfactory. By March, production is expected to be put on a profitable basis.

. . . . Deposits of barium sulphate, gold, and galena are reported to have been discovered in the State of Alwar, Madras Residency, southeastern India. Experts here state that the cost of marketing barium is excessive and that the new deposits probably cannot compete with Russian production.

■

Government Buys Huge Nugget Found in Western Australia

Melbourne, Jan. 31. — The Western Australian government has purchased the huge nugget, called the Golden Eagle, which was found on Jan. 18 at Larkinville, 35 miles south of Coolgardie, in the Kalgoorlie district. The nugget contains 1,135 oz. of gold and will be exhibited throughout Australia as well as overseas in the hope of stimulating interest in gold mining. Larkinville was first discovered in October, and since then has been the scene of considerable prospecting. Other nuggets, varying in size from 25 to 113 oz., have been found from time to time. The discovery of the Golden Eagle has caused a rush to the camp, and now more than 600 men are on the field. A seventeen-year old prospector was the fortunate finder of the Golden Eagle.

. . . . Production of gold in Western Australia in 1930 was 416,369 oz., an increase of 39,193 oz. over production in 1929. The value of the output was £1,768,623. Production in Victoria in 1930 was 24,119 oz., a decrease of 2,156 oz. The value was £102,456. British capital to the extent of £80,000 has been made available for development of the Caralulup mine, near Maryborough, northwest of Melbourne, Victoria. An English company has taken a six months' option on the Madam Hopkins Deep Lead mine, in the same district. Maryborough is not far from Ballarat and Bendigo.

. . . . The miners at Broken Hill, New South Wales, have agreed to work for the next twelve months for the basic state wage of £4 2s. 6d. a week, plus an additional 7s. 6d., or a total of £4 10s. These are the terms originally offered by the mines. This agreement can be terminated by a two months' notice by either the workers or the mining companies. Only the three largest companies, North Broken Hill, Broken Hill South, and Zinc Corporation, have resumed operations, however. Production of lead, silver, and zinc is greatly curtailed.

. . . . Electrolytic Zinc will pay no dividend for the half year ended Dec. 31. Its last payment, made in September, was 9.6d., on both the ordinary and the preferred shares. The Magnet lead and North Farrell lead-zinc mines, on the West coast of Tasmania, have suspended operations. North Farrell had been operating on a curtailed basis. Although neither property is a very large producer, their closing deals a further blow to the Tasmanian mining industry, which had been hard hit by the suspension at the Rosebery-Mount Read zinc mines and the tin properties.

. . . . For the quarter ended Dec. 31, Mount Lyell Mining & Railway treated 63,762 long tons of ore at its property in Tasmania. Production was 12,361 long tons of concentrate, 2,236 long tons of refined copper, 39,052 oz. of silver, and 913 oz. of gold. Although the tonnage of ore treated was virtually unchanged, metal production was considerably lower than in the preceding quarter, probably the result of construction work at the refinery. In the September quarter, copper output was 2,901 long tons.

. . . . The first shipment of dredge material for the new Bulolo Dredging units has arrived at Lae, New Guinea. It amounts to about 130 tons of equipment. The second Junker plane is due to arrive in the middle of February and will be immediately pressed into service for transportation of dredging and power equipment.

■

Roan Mill, Power Plant Are Near Completion

London, Jan. 31.—At the Roan Antelope property, near N'Dola, Northern Rhodesia, virtually the entire plant, with the exception of the smelter, is near completion. Because the new 5,000-ton mill will be ready for operation ahead of the smelter, concentrates will be shipped to England for smelting in the early stage. Experimental work has indicated that a high-grade concentrate can be made, so that transportation costs will not be greatly in excess of those on blister copper.

. . . . Drill hole NE 48 on the N'Changa West Extension property of Rhodesian Congo Border Concession has now cut a total of 70 ft. of ore, from 1,300 to 1,370 ft., in the lower or River lode horizon. An average core recovery of 58 per cent assayed 6.69 per cent copper, of which 4.82 per cent was sulphide. The first unit of the permanent power plant has been virtually completed at the property. It will be used to expedite the work of shaft sinking, as development to date has been almost entirely through diamond drilling.

. . . . Mufulira Mines reports three new holes, put down to test the fringe of its rich No. 2 orebody, have cut an average width of 11.77 ft. of ore at a depth of about 275 ft. The grade is 6.82 per cent copper, nearly all sulphide. A large part of this orebody will average 10 per cent copper. It is being developed to supply the first 1,500-ton unit of the 5,000-ton mill, expected to be ready early in 1932. Concentrate will be shipped to the Roan smelter.

Russian Aluminum Contract May Go to Norway

Berlin, Jan. 31.—Russia is negotiating for the purchase of 9,000 metric tons of aluminum from Norway. The Aluminum Company of America, which controls the Norsk Aluminum Company, operating at Höianger, is said to be involved in the negotiations. Norwegian production of aluminum has been increasing steadily, the capacity of the Höianger plant having been recently enlarged to 11,000 metric tons annually. Although Russia plans construction of a 10,000-ton plant at Dnieprostroi, where a large supply of cheap power is available, and a 6,000-ton unit at Leningrad, at present it produces no aluminum. Germany and France have been the chief sources of supply to the Soviet government.

. . . . Exports of metals in semi-manufactured form from Germany during 1930 totaled 99,070 metric tons, valued at about 162,000,000 marks, compared with 90,863 metric tons, valued at about 171,000,000 marks, in 1929.

. . . . Sales of the Copper Exporters, Inc., at Brussels, are now said to be as low as 500 tons of copper daily.

■

Orange Free State Finds Attract Gold Miners

Johannesburg, Jan. 28.—Local interest has been aroused by gold discoveries reported in the Rouxville and Zastron districts, of the Orange Free State, Union of South Africa. Several Rand engineers are inspecting the discoveries. Options on ground in these districts are reported to have been taken by financial houses. Gold apparently occurs over a wide area, but the grade seems to be extremely erratic. A great deal of work will have to be done before the importance of the field can be determined. Orange Free State has produced no gold at all within the last few years. Rouxville is in the southeastern corner of the state, near the Basutoland boundary. It is about 25 miles from the nearest railroad, at Aliwal, to the southwest. Zastron is a few miles northeast of Rouxville.

. . . . Ore reserve calculations, published by the Witwatersrand Mines, indicate a generally sound position for the industry, although several decreases are shown. Perhaps the most significant estimate is that of Crown Mines, which puts the ore blocked out in its workings at 12,285,210 tons, averaging 6.75 dwt. of gold per ton over a width of 46.8 in. This compares with 10,841,460 tons at the end of 1929, and indicates an increase of 1,443,750 tons, despite extraction of nearly 3,000,000 tons during the year. Production during 1930 increased from 220,000 tons monthly to nearly 260,000 tons, and working costs were reduced from an average of 20s. 5d. in 1929 to an average of 19s. 11d. for the last four months of the year.

. . . . Randfontein, on the West Rand, which is the second largest producer, from a tonnage standpoint, in the entire Witwatersrand district, is now making a monthly profit of about £45,000 from the treatment of about 220,000 tons. This compares with £22,500 and 210,000 tons in 1929. The company has paid no dividends since 1925, but it is anticipated that profits will further increase to about £60,000 monthly and that resumption of dividends will be practicable after the discharge of debenture obligations.

. . . . Shares of gold-mining companies are very active, with a rising tendency, on the Johannesburg exchange. The sound position of the industry is evidently recognized. In the meanwhile, the Low-Grade Ore Commission is continuing its sessions at Cape Town. A vast amount of evidence dealing with the problems of making ore out of the vast quantities of junore that exist on the Rand is being collected, and the issuing of an interim report is probable.

. . . . A new draft of the Mining Act will be introduced in the Rhodesian Legislature when it meets in March. It will recognize the "unalienable mineral rights" of the British South Africa (Chartered) Company in Rhodesia, and is likely to cause much discussion.

■

Suspend Production at Bwana

London, Feb. 4.—Production is being suspended at the Bwana mine of Rhodesian Congo Border Concession, in Northern Rhodesia. This property is at present the only large producer in Northern Rhodesia, with an average monthly output of about 600 short tons of copper from its leaching plant, which has been handling 1,000 tons of ore daily. For the last quarter of 1930, output was 1,935 short tons, including about 330 tons produced from N'Kana concentrate. Costs at Bwana, according to the last available data, were about 12 or 13c. a pound. Although this has probably been somewhat reduced, the fact that the unit has been operating at a loss undoubtedly caused the directors of R.C.B.C., which recently acquired Bwana, to decide to concentrate operations at the N'Changa, N'Changa Extension, and N'Kana mines, now under development.

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BRIEF NOTES

Argonaut Mining. The Plymouth property, near Plymouth, Calif., has been acquired and reopened. A crosscut is being driven on the 900 level by the company to cut the north extension of the Empire vein.

Bagdad Copper. Operations have been greatly curtailed at the property at Hillside, Ariz., as the company is content to await improvement in the metal market before attempting to finance construction of a treatment plant. It has ample cash reserves in the bank to permit such a policy. When copper prices do improve, either a 5,000- or 10,000-ton plant will be built. Reserves are sufficient to supply ore for ten years at the rate of 10,000 tons daily. Annual production on that basis would be 60,000,000 lb. of copper. Construction of town, power plant, concentrator, and electrolytic unit to produce copper by the Wetherbee process would cost $6,400,000 for a 5,000-ton plant and $8,000,000 for a 10,000-ton one, according to estimates that have recently been prepared by the company.

Bonanza Mining. This company, which has been operating a leased area in the Park Bingham property at Bingham, Utah, has now leased the entire mine. It adjoins the United States mine of U. S. Smelting, Refining & Mining. Production of silver-lead ore is about 50 tons daily.

Central Eureka. The company has discontinued mining from its Central shaft at Sutter Creek, Calif. Operations are concentrated on the Eureka property, from which output is 4,000 tons of ore monthly. Present plans include the abandoning of the South Eureka shaft, used as a secondary shaft.

Consolidated Syndicate Gold Mines. A. R. Archibald, of Grass Valley, Calif., has formed the company to develop and operate the Central Consolidated, Banner, New England, and Norambague properties. Preliminary work has been started on the Central Consolidated.

International Nickel. Beginning in February, production at the Frood mine, near Sudbury, Ont., has been increased to 4,000 tons daily, or 100,000 tons monthly, compared with the former basis of 75,000 tons monthly. This increase has been more than offset by decreases at the company's other properties. It has been undertaken to further the company's policy of centering operations at the low-cost Frood unit. Most of the 1,500 men at the Frood are now working a five-day week.

Kennedy Mining. Experiments are being made with a flotation unit in the mill, near Jackson, Calif. At present, the pulp is passed over amalgamating plates and then over vanners. Part of the pulp is reground in a tube mill. At the Murchie mine, near Nevada City, flotation units have been in operation on gold ore for some time. Flotation treatment is also being tested at the Empire-Star and Bodie gold properties.

Lake View & Star. Operation of the initial 150-ton flotation unit at the company's mill, Kalgoorlie, Western Australia, has been so successful that the plant will be enlarged to 1,000 long tons daily, all ore to be handled by flotation. At present, about 400 tons of gold ore is treated daily, of which 40 per cent comes from leasers. Underground development has definitely blocked out 1,000,000 long tons, averaging 31s. 8d. per ton. An additional 1,000,000 tons of higher grade is indicated.

North Carolina Exploration. This company acquired possession of its Fontana mine, Swain County, N. C., on Jan. 30, when Ducktown Chemical & Iron, which had been operating the mine under lease, relinquished the property. About 8,000 long tons of copper ore had been shipped monthly to the Isabella smelter of Ducktown C. & I., in Tennessee, during the last year. North Carolina Exploration purchased Fontana in the autumn of 1930, having agreed that Ducktown C. & I. continue operations until its lease expired on Feb. 6. Relinquishing of the mine on Jan. 30 has been effected by mutual agreement.

Old Dominion. Production at the property, near Globe, Ariz., has been cut from 1,600,000 lb. monthly to slightly over 1,000,000 lb. Work of concreting the main shaft has been stopped and development and construction are being reduced to the minimum amount possible. The payroll has been reduced from 800 to 500 men, but further reductions are not contemplated.

MARKET AND FINANCIAL NEWS

Copper Sales on 9.50c. Basis—Further Decline in Lead and Silver

New York, Feb. 5, 1931.—With no appreciable increase in buying, the trend of prices in non-ferrous metals again was downward. Copper sold at 9½c., delivered Connecticut, equaling the previous low established last October. Lead declined to a new low for the movement, settling at 4½c., New York, a net loss of a quarter of a cent. Most of the business transacted in zinc was closed at slightly firmer levels than those which obtained in the previous fortnight, but the market seemed to ease off again on the last day or two. Tin showed little net change. Silver broke sharply on continued weakness in China exchanges. Platinum was reduced $2 per ounce by the leading seller. Cadmium declined to 55c. per pound to meet foreign competition. Both antimony and quicksilver were available at lower prices.

Copper Price Declines

Continued pressure to sell by second-hands in a quiet trading period brought out sufficient weakness in sentiment to depress the views of both domestic and foreign consumers, for the market passed through another dull period. On Thursday, Jan. 29, custom smelters sold copper on the basis of 9¾c. per pound, delivered Connecticut, a decline of ¼c. This price held until Feb. 3, when transactions were noted at 9½c., delivered. Of the moderate tonnage sold in the domestic market a fair quantity was for delivery over the second quarter of the year.

Demand for copper products has been disappointing. The improvement in demand has been slight, owing chiefly to the inactivity of the electrical industry. The January statistics for North and South America are expected to show another moderate decline in total stocks.

The export price was reduced by Copper Exporters, Inc., on Jan. 31 from 10.30c. to 10.05c. Export sales for the month of January totaled about 35,000 long tons, against 31,000 long tons in December.

Lead Cut to 4½c.

American Smelting & Refining cut its contract price for New York lead from 4.75c. to 4.60c. on Feb. 3, and on the following day another reduction was announced, bringing the price down to 4½c. Neither reduction had much effect in stimulating business. As usual, other sellers followed the lead of the Smelting company in reducing prices. In St. Louis, some business was placed on both Feb. 3 and 4 before the decline took place, which accounts for the range in prices quoted for those days. The primary cause of the decline in prices was the fact that smelters were taking in more lead than they could sell. Lead production of the world for 1930 totaled 1,833,881 short tons, according to the American Bureau of Metal Statistics, which compares with 1,944,234 tons in 1929.

Little Change in Zinc

A good tonnage of zinc was sold in the first week of the period under review, which, together with smaller offerings of concentrate, appeared to steady the market. Subsequent weakness in other metals had a depressing influence on the trade and prices became unsettled again, offerings increasing at close to 4c. St. Louis basis for Prime Western. Shipments for January are expected to show a gain, and with the output continuing on a reduced scale, the statistics are likely to show further improvement. Producers are inclined to demand a slight premium on forward business.

Tin Steady

Reports that the tin limitation was likely to apply to production beginning March 1, rather than to exports, led London operators to take a firmer view of the market, though the net change for the two weeks has been small. At no time has the market here been active. United States deliveries in January were 7,210 long tons, probably in excess of consumption, compared with 7,495 in December, and 5,815 in January, 1930. World's visible supply on Jan. 31 was reported as 43,619 long tons, against 42,498 on Dec. 31, and 29,032 long tons a year ago.

Average Metal Prices for January, 1931

COPPER:	
Electrolytic, refinery	9.838
London Standard Spot	44.938
London Electrolytic, Bid	47.524
LEAD:	
New York	4.802
St. Louis	4.604
London Spot	13.872
London Forward	13.905
SILVER:	
New York	29.423
London	13.810
Sterling Exchange	485.260
ZINC:	
St. Louis	4.035
London Spot	12.747
London Forward	13.113
TIN:	
Straits	26.137
London Standard Spot	115.798
QUICKSILVER	103.000
ANTIMONY	7.317
PLATINUM, Refined	36.000
ALUMINUM, 99 Per Cent Plus	23.300

Silver Makes New Low

The silver market suffered a further decline, caused by continued weakness in China exchanges in addition to sales by both China and India. Prices touched a new record low in New York on Feb. 3, of 27⅛c., and in London on Feb. 4, of 12 7/16d. The New York market showed some improvement on Feb. 4 as a result of a good demand with lack of supplies.

Other Metals

Quotations cover wholesale lots, f.o.b. New York, unless otherwise specified. London prices are according to latest mail advices.

ALUMINUM—Per lb., delivered, Alcoa commercial and mill ingot, 99 and 98 per cent, 23.30c.; Alcoa No. 12 alloy, 22c.; metallurgical ingot, 94 per cent plus, 23.30c.; 98@99 per cent, 22.90c. London, £85, less 2 per cent, per long ton, for 98 per cent ingots and bars.

ANTIMONY — Per lb., duty paid, Chinese spot, 7.05@7.10c.; futures, 7c. Demand quiet. Cookson's "C" grade, spot, 12⅞c. "C.M.C." grade, 99.9 per cent, spot, 10¾c.

Daily Prices of Metals

Jan. Feb.	Electrolytic Copper	Straits Tin	Lead		Zinc
	Refinery	New York	New York	St. Louis	St. Louis
22	9.775	25.90	4.75	4.55	4.00
23	9.775	26.00	4.75	4.55	4.00@4.125
24	9.775	26.00	4.75	4.55	4.00@ 4.125
26	9.775	25.75	4.75	4.55	4.00 @4.125
27	9.775	26.00	4.75	4.55	4.025@4.125
28	9.775	25.80	4.75	4.55	4.05 @4.125
Av'ge	9.775	25.908	4.750	4.550	4.058
29	9.525	25.50	4.75	4.55	4.05
30	9.525	25.40	4.75	4.55	4.05
31	9.525	25.375	4.75	4.55	4.05
2	9.525	25.25	4.75	4.55	4.10 @4.15
3	9.275	25.25	4.60	4.40@4.55	4.05
4	9.275	25.75@26.125	4.50	4.30@4.40	4.05
Av'ge	9.442	25.452	4.683	4.504	4.063

Average metal prices for calendar week ended January 24, 1931, are: Copper, 9.775c.; Straits tin, 26.029c.; New York lead, 4.750 c.; St. Louis Lead, 4.550c.; Zinc, 4.021c.; Silver, 29.458c.

Average metal prices for calendar week ended January 31, 1931, are: Copper, 9.650c.; Straits tin, 25.638c.; New York lead, 4.750c.; St. Louis lead, 4.550c.; Zinc, 4.063c.; Silver, 29.125c.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices are quoted on a delivered basis; that is, delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices of refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted.

Quotations for copper are for the ordinary forms or wirebars and ingot bars. For ingots an extra 0.05c. per pound is charged; for slabs, 0.075c.; and for cakes, 0.125c. up, depending on weight. Cathodes are sold at a discount of 0.125c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight differential. The contract price for High-Grade zinc delivered in the East and Middle West is 1c. above the St. Louis price for Prime Western.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

Silver, Gold, and Sterling Exchange

Jan.	Sterling Exchange "Checks"	Silver		Gold, London	Jan. Feb.	Sterling Exchange "Checks"	Silver		Gold, London
		New York	London				New York	London	
22	$4.85\frac{1}{4}$	$29\frac{3}{8}$	$13\frac{15}{16}$	84s11$\frac{3}{8}$d	29	$4.85\frac{1}{4}$	$28\frac{7}{8}$	$13\frac{13}{16}$	84s11$\frac{1}{4}$d
23	$4.85\frac{1}{8}$	$29\frac{1}{4}$	$13\frac{15}{16}$	84s11$\frac{1}{2}$d	30	$4.85\frac{7}{16}$	$28\frac{3}{4}$	$13\frac{9}{16}$	84s11$\frac{1}{2}$d
24	$4.85\frac{3}{16}$	$29\frac{3}{8}$	$13\frac{15}{16}$	.....	31	$4.85\frac{1}{2}$	$28\frac{3}{8}$	$13\frac{3}{8}$	.....
26	$4.85\frac{3}{16}$	$29\frac{1}{4}$	$13\frac{13}{16}$	84s11$\frac{1}{2}$d	2	$4.85\frac{1}{2}$	$28\frac{1}{8}$	$13\frac{1}{4}$	84s11$\frac{1}{2}$d
27	$4.85\frac{3}{8}$	$29\frac{1}{4}$	$13\frac{7}{8}$	84s11$\frac{1}{2}$d	3	$4.85\frac{5}{16}$	$27\frac{1}{8}$	$12\frac{13}{16}$	84s11$\frac{1}{2}$d
28	$4.85\frac{5}{16}$	$29\frac{1}{2}$	$13\frac{7}{8}$	84s11$\frac{1}{2}$d	4	$4.85\frac{1}{2}$	$27\frac{1}{4}$	$12\frac{7}{16}$	84s11$\frac{1}{2}$d

Average for week ended January 28: Silver, 29.542c.; Sterling Exchange, $4.85219.
Average for week ended February 4: Silver, 28.125c.; Sterling Exchange, $4.85417.

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of silver, 999 fine. London silver quotations are in pence per troy ounce of bar silver, basis of 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command three-sixteenths cent premium.

London

Jan. Feb.	Copper Standard		Electrolytic (Bid)	Tin		Lead		Zinc	
	Spot	3 M		Spot	3 M	Spot	3M	Spot	3 M
22	$44\frac{7}{8}$	$44\frac{13}{16}$	47	$115\frac{5}{8}$	$117\frac{1}{4}$	$13\frac{5}{8}$	$13\frac{11}{16}$	$12\frac{9}{16}$	$12\frac{13}{16}$
23	$44\frac{13}{16}$	$44\frac{11}{16}$	$47\frac{1}{2}$	$114\frac{1}{2}$	$115\frac{5}{8}$	$13\frac{1}{2}$	$13\frac{9}{16}$	$12\frac{5}{16}$	$12\frac{9}{16}$
26	$44\frac{1}{2}$	$44\frac{7}{16}$	$47\frac{1}{4}$	$114\frac{1}{2}$	$115\frac{1}{4}$	$13\frac{5}{16}$	$13\frac{3}{8}$	$12\frac{1}{4}$	$12\frac{1}{2}$
27	$44\frac{1}{2}$	$44\frac{1}{4}$	47	115	$116\frac{1}{2}$	$13\frac{5}{16}$	$13\frac{1}{4}$	$12\frac{3}{8}$	$12\frac{5}{8}$
28	$44\frac{5}{16}$	$44\frac{3}{16}$	47	$115\frac{1}{4}$	$116\frac{5}{8}$	$13\frac{3}{8}$	$13\frac{3}{8}$	$12\frac{1}{4}$	$12\frac{5}{8}$
29	44	$43\frac{15}{16}$	$46\frac{1}{2}$	$113\frac{7}{8}$	$115\frac{1}{2}$	$13\frac{3}{16}$	$13\frac{3}{16}$	$12\frac{1}{4}$	$12\frac{9}{16}$
30	$44\frac{1}{8}$	$44\frac{1}{16}$	$46\frac{1}{2}$	$113\frac{7}{8}$	$115\frac{1}{4}$	$13\frac{3}{16}$	$13\frac{3}{16}$	$12\frac{1}{4}$	$12\frac{9}{16}$
2	$43\frac{9}{16}$	$43\frac{3}{4}$	46	$113\frac{3}{4}$	$114\frac{3}{4}$	$12\frac{15}{16}$	13	$11\frac{7}{8}$	$12\frac{3}{8}$
3	$43\frac{7}{16}$	$43\frac{5}{16}$	$45\frac{1}{2}$	$112\frac{1}{4}$	$113\frac{5}{8}$	$12\frac{15}{16}$	13	$11\frac{3}{4}$	$12\frac{1}{4}$
4	$43\frac{3}{8}$	$43\frac{3}{8}$	46	$114\frac{3}{8}$	$116\frac{1}{8}$	$12\frac{13}{16}$	$12\frac{7}{8}$	$11\frac{9}{16}$	$12\frac{3}{16}$

Prices for lead and zinc are the official prices for the morning session of the London Metal Exchange; prices for copper and tin are the official closing buyers' prices. All are in pounds sterling per long ton (2,240 lb.).

BISMUTH—Per lb., $1.25. London, 5s., for lots of 500 lb. or more.

CADMIUM—Per lb., 55c. London, 1s. 9½d.@1s. 10½d.

IRIDIUM—Per oz., $160 for 98@99 per cent sponge and powder. London, £33@£35.

NICKEL—Per lb. electrolytic cathodes, 35c.; shot and ingot made from remelted electro, 36c., for single lots of spot metal. London, per long ton, £170 @£175, as to quantity.

PALLADIUM—Per oz., $19@$21. London, £3 15s. to £4 5s.

PLATINUM—Per oz., official price of leading interest was reduced from $36 to $34 on Feb. 2. Cash transactions between dealers several dollars less. London quotes from £6 10s. to £6 15s., as to quantity.

QUICKSILVER—Per 76-lb. flask, $100 @$101. Business continues quiet and prices are largely nominal. London reports the market unchanged at £22 7s. 6d. per flask.

Chromium, Cobalt, Magnesium, Manganese, Molybdenum, Osmium, Radium, Rhodium, Ruthenium, Selenium, Silicon, Tantalum, Tellurium, Thallium, and Tungsten are unchanged from prices given in the Jan. 26 issue.

Metallic Ores

Prices in tons of 2,000 lb., or in "Units" of 20 lb., unless otherwise stated.

CHROME ORE—Per long ton, c.i.f. Atlantic ports, Indian ores, $19 for 46@48 per cent Cr_2O_3 ore, and $23.50@$24 for 50@51 per cent ore. London, 77s. 6d. for 48 per cent Rhodesian, and 80@95s. for Indian and New Caledonian, according to quality.

IRON ORE—Per unit, foreign ores alongside docks Atlantic ports, cargo lots, North African and Swedish, low phosphorus, 9½@10c.; Spanish and North African basic, 50 to 60 per cent, 9@9½c. Other prices in Jan. 26 issue.

MANGANESE ORE—Per long ton unit of Mn, c.i.f. North Atlantic ports, cargo lots, exclusive of duty of 1c. per lb. of Mn contained: Indian, 48 to 50 per cent, 26@27c., nominal. South African, 52 to 54 per cent, 25@26c. Caucasian, 52@55 per cent, 25@26c. per long ton unit.

Chemical grades, per ton, in carload lots, powdered, coarse, or fine, $60, f.o.b. mines or Atlantic ports.

TUNGSTEN ORE—Per unit of WO_3, New York: Chinese wolframite, duty paid, $11.50. Nominal. Bolivian scheelite, $11.50@$12; domestic scheelite, $12.

Antimony, Beryllium, Molybdenum, Tantalum, Tin, Titanium, Vanadium, and Zircon ores are unchanged from prices given in the Jan. 26 issue .

Metal Statistics

Monthly Average Prices of Metals

Silver

	New York		London Spot		Sterling Exchange	
	1930	1931	1930	1931	1930	1931
January	45 000	29.423	20 896	13.810	486 447	485.260
February	43.193	.....	20 008	.....	485.784	.....
March	41.654	.....	19 298	.....	485.933	.....
April	42.428	.....	19 554	.....	486 019	.....
May	40.736	.....	18 850	.....	485.724	.....
June	34.595	.....	16 049	.....	485.625	.....
July	34 346	.....	15.928	.....	486.300	.....
August	35 192	.....	16.283	.....	486 839	.....
September	36.315	.....	16.738	.....	485.888	.....
October	35.846	.....	16 563	.....	485.719	.....
November	35.908	.....	16.625	.....	485.454	.....
December	32 635	.....	15 201	.....	485 413	.....
Year	38 154	.....	17 666	.....	485.929	.....

New York quotations, cents per ounce troy, 999 fine. London, pence per ounce, sterling silver, 925 fine. Sterling exchange in cents.

Copper

	F.O.B. Refinery		London Spot			
	Electrolytic		Standard		Electrolytic	
	1930	1931	1930	1931	1930	1931
January	17.775	9.838	71.469	44.938	83.250	47.524
February	17 775	.....	71.419	.....	83.500	.....
March	17.775	.....	69.202	.....	83.405	.....
April	15 621	.....	62.075	.....	74.338	.....
May	12.756	.....	53.159	.....	59.545	.....
June	12.049	.....	50.003	.....	56.750	.....
July	11.023	.....	48.277	.....	52.522	.....
August	10.693	.....	47.525	.....	50.725	.....
September	10 310	.....	46.264	.....	49.500	.....
October	9.597	.....	43.030	.....	45.772	.....
November	10.113	.....	46.134	.....	48.963	.....
December	10.300	.....	46.771	.....	50.065	.....
Year	12.982	.....	54.611	.....	61.528	.....

New York quotations, cents per pound London, pounds sterling per long ton

Lead

	New York		St. Louis		London			
	1930	1931	1930	1931	1930 Spot	1930 3 Mos.	1931 Spot	1931 3 Mos.
January	6.250	4.802	6.100	4.604	21.545	21.571	13.872	13.905
February	6 236	.....	6 086	.....	21 188	21.097	.....	.....
March	5.662	.....	5.542	.....	18.807	18.940	.....	.....
April	5.537	.....	5.428	.....	18.319	18.363	.....	.....
May	5.523	.....	5.408	.....	17.795	17.861	.....	.....
June	5.410	.....	5.310	.....	17.941	17.994	.....	.....
July	5.250	.....	5.149	.....	18.160	18.063	.....	.....
August	5.488	.....	5.340	.....	18.294	18.178	.....	.....
September	5.500	.....	5.348	.....	17.909	17.798	.....	.....
October	5.151	.....	4.999	.....	15.747	15 674	.....	.....
November	5.100	.....	4.950	.....	15.934	15.931	.....	.....
December	5.100	.....	4.950	.....	15.283	15.292	.....	.....
Year	5.517	.....	5.384	.....	18.077	18.064	.....	.....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Tin

	New York		London	
	1930	1931	1930	1931
	Straits		Spot	
January	38.851	26.137	175.466	115.798
February	38.676	.....	173.750	.....
March	36.798	.....	164.831	.....
April	36.077	.....	162.638	.....
May	32.108	.....	144.818	.....
June	30.336	.....	136.300	.....
July	29.822	.....	134.511	.....
August	30.044	.....	134.988	.....
September	29.647	.....	132.631	.....
October	26.802	.....	117.451	.....
November	25.904	.....	113.519	.....
December	25.262	.....	111.560	.....
Year	31.694	.....	141.873	.....

New York quotations, cents per pound. London, pounds sterling per long ton.

Zinc

	St. Louis		London			
	1930	1931	1930 Spot	1930 3 Mos.	1931 Spot	1931 3 Mos.
January	5.229	4.035	19.634	20.241	12.747	13.113
February	5.180	.....	19.209	19.778	.....	.....
March	4.934	.....	18.304	18.810	.....	.....
April	4.843	.....	17.819	18.378	.....	.....
May	4.641	.....	16.639	17.330	.....	.....
June	4.441	.....	16.422	17.038	.....	.....
July	4.350	.....	16.171	16.777	.....	.....
August	4.360	.....	15.953	16.469	.....	.....
September	4.270	.....	15.773	16.080	.....	.....
October	4.059	.....	14.446	14.935	.....	.....
November	4.266	.....	14.706	15.238	.....	.....
December	4.099	.....	13.762	14.214	.....	.....
Year	4.556	.....	16.570	17.107	.....	.....

St. Louis quotations, cents per pound. London pounds sterling per long ton

Antimony, Quicksilver, and Platinum

	Antimony (a) New York		Quicksilver (b) New York		Platinum (c) New York	
	1930	1931	1930	1931	1930	1931
January	8.606	7.317	121.192	103.000	61.923	36.000
February	8.830	.....	120.500	.....	59.909	.....
March	8.236	.....	118.808	.....	54.769	.....
April	7.740	.....	114.000	.....	46.462	.....
May	7.454	.....	117.269	.....	46.000	.....
June	7.057	.....	118.600	.....	46.000	.....
July	6.976	.....	117.462	.....	43.692	.....
August	7.839	.....	116.000	.....	41.462	.....
September	7.773	.....	113.620	.....	36.080	.....
October	7.288	.....	110 596	.....	36 000	.....
November	7.105	.....	106.717	.....	36 000	.....
December	7.099	.....	105 346	.....	36.000	.....
Year	7 667	.....	115 009	.....	45.358	.....

(a) Antimony quotations in cents per pound, for ordinary brands. (b) Quicksilver in dollars per flask of 76 lb. (c) Platinum in dollars per ounce.

Pig Iron[1] and Aluminum

	Bessemer		Basic		No. 2 Foundry		Aluminum	
	1930	1931	1930	1931	1930	1931	1930	1931
Jan	19 00	17.50	18.50	17.00	18.50	17.00	24.300	23.300
Feb	19 00	.....	18 50	.....	18.50	.....	24.300	.....
March	19 00	.....	18 50	.....	18 50	.....	24.300	.....
April	19 00	.....	18 50	.....	18 50	.....	24.300	.....
May	19.00	.....	18.50	.....	18.50	.....	24.300	.....
June	19 00	.....	18 50	.....	18.50	.....	24.140	.....
July	18.62	.....	18 12	.....	18.12	.....	23.300	.....
Aug	18.50	.....	18 00	.....	18 00	.....	23.300	.....
Sept	18.38	.....	17 76	.....	17 88	.....	23.300	.....
Oct	17.85	.....	17 00	.....	17 22	.....	23.300	.....
Nov	17.50	.....	17 00	.....	17.00	.....	23.300	.....
Dec	17 50	.....	17 00	.....	17.00	.....	23.300	.....
Year	18 53	.....	17 99	.....	18.02	.....	23.787	.....

Iron in dollars per long ton. Aluminum in cents per pound, 99 per cent grade.

[1]F.o.b. Mahoning and Shenango valley furnaces; freight to Pittsburgh, $1.76

Monthly Crude Copper Output in Short Tons

	1929 Total	1930 Total	1930 Sept	1930 Oct.	1930 Nov.	1930 Dec.
Domestic						
Alaska shipments	21,947	18,953	2,223	2,438	1,883	1,817
Calumet & Arizona	65,246	45,161	3,730	3,836	3,608	3,166
Magma	19,118	15,940	1,577	1,623	1,940	1,203
Miami	29,567	34,568	2,701	2,798	2,657	2,611
Nevada Cons.	133,140	.....	(d)16,686	.....	.....	.....
Old Dominion (a)	11,172	10,428	756	781	824	879
Phelps Dodge (b)	111,026	72,308	6,014	6,015	5,718	5,151
United Verde Extens.	29,669	21,908	1,886	1,702	1,504	1,236
Tennessee Copper	7,870	7,772	597	656	667	646
Foreign						
Andes Copper	83,718	.....	3,941	3,936	.....	.....
Braden	88,155	.....	8,212	10,299	.....	.....
Boleo, Mexico	12,898	13,940	(d) 3,537	.....	.....	(d) 3,288
Bwana M'Kubwa	6,988	.....	617	571	497	.....
Chile	150,247	.....	7,486	7,480	.....	.....
Furukawa, Japan	17,767	.....	1,642	1,611	1,432	.....
Granby Cons., Canada	30,424	.....	2,333	1,882	1,771	.....
Howe Sound	21,516	22,633	(d) 5,828	.....	.....	(d) 5,231
Messina	(c) 7,200	.....	824	780	826	.....
Mt. Lyell	9,731	10,878	(d) 3,249	.....	.....	(d) 2,504
Sumitomo, Japan	20,180	.....	1,110	2,202	1,554	.....

(a) Includes Arizona Commercial. (b) Moctezuma is included. (c) Estimated. (d) Three months

Monthly Production of Primary Copper from U. S. Mines and Daily Rate (Short Tons)

	1928 Monthly Production	1928 Daily Rate	1929 Monthly Production	1929 Daily Rate	1930 Monthly Production	1930 Daily Rate
January	68,469	2,209	86,324	2,785	67,838	2,188
February	67,423	2,352	84,735	3,026	59,196	2,114
March	70,327	2,269	93,698	3,023	61,216	1,975
April	69,721	2,324	94,902	3,163	60,450	2,015
May	73,729	2,378	93,392	3,013	60,238	1,943
June	73,224	2,441	82,354	2,745	56,743	1,891
July	73,426	2,369	79,229	2,556	54,249	1,750
August	76,952	2,482	78,885	2,545	56,779	1,832
September	78,341	2,611	79,402	2,647	56,584	1,886
October	86,480	2,790	82,575	2,664	55,954	1,805
November	85,382	2,846	75,934	2,531	53,141	1,771
December	85,677	2,764	74,772	2,412	48,518	1,565
Total	909,051	.....	1,006,203	.....	690,263	.....
Monthly average	75,754	.....	83,850	.....	57,522	.....
Av. of daily rate	.....	2,484	.....	2,757	.....	1,891